NIOSH

A Guide for the Management, Analysis, & Interpretation of OCCUPATIONAL MORTALITY DATA

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control
National Institute for Occupational Safety and Health

CDC
CENTERS FOR DISEASE CONTROL

A GUIDE FOR THE MANAGEMENT, ANALYSIS, AND INTERPRETATION OF OCCUPATIONAL MORTALITY DATA

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ABSTRACT

This report provides guidelines for state health departments interested in occupational mortality surveillance. Since 1980, the National Institute for Occupational Safety and Health (NIOSH) has promoted cooperative occupational health surveillance activities with state health departments. This report draws from our experience with the states to date, providing guidelines on data collection, data processing, analyses, and follow-up. Methods for improving data quality are described, coding procedures are discussed, and statistical measures are compared and contrasted. The report includes a lengthy reference list and a list of contact persons at NIOSH and in the state health departments. This report represents a continuing NIOSH commitment to state health departments in their efforts to promote occupational safety and health programs.

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INTRODUCTION

The incidence and prevalence of occupational disease, disability, and mortality are largely unknown. Weaknesses in systems used to measure the prevalence of occupational disease caused the National Institute for Occupational Safety and Health (NIOSH) to evaluate alternative approaches for the surveillance of occupational morbidity and mortality. Since 1980, NIOSH has promoted cooperative occupational health surveillance activities with state health departments (hereafter referred to as the "states") as one alternative to the prevailing national systems sponsored by the Department of Labor.

The following document provides a descriptive summary of various aspects of data collection, processing, analysis, and follow-up. The information is drawn from our experience with the states to date and highlights activities directed to the surveillance of occupational mortality. In principle, the framework used for mortality surveillance may apply as well to morbidity surveillance.

The document provides ample reference to professional and technical literature. Though not an annotated bibliography, we attempt to provide the reader with the literature citations necessary to understand the epidemiologic and statistical underpinnings of a surveillance activity.

The document also identifies state and federal resource people (see Reference section and Appendix A). Your efforts to develop and implement a successful surveillance program will require technical assistance from outside sources. The individuals and agencies noted herein should be consulted as you progress through the various stages of program development.

Finally, the document provides evidence of a continuing NIOSH commitment to state health departments in their efforts to promote occupational safety and health programs. We view this document as the first of many installments, to be followed by discussions of other NIOSH surveillance activities.

DATA COLLECTION

Most state occupational mortality surveillance activities revolve around the use of the death certificate. Information gathered from the death certificate can be easily adapted for surveillance purposes. Information about the decedent's race, sex, age, and the cause of death are routinely coded and computerized by state health department staff. Many states also code and computerize employment information from the death certificate. Most state health departments are experienced in collecting and processing the medical and basic demographic data, which follow the guidelines of the Vital Statistics Cooperative Program of the National Center for Health Statistics (NCHS). Therefore this section and the section on data processing will focus on the employment data.

The United States' recommended standard death certificate provides for information on the decedent's usual occupation ("kind of work done during most of working life, even if retired") and usual industry ("kind of business or industry"). These statements are used as a surrogate for detailed occupational history. Studies comparing "usual" industry and occupation as reported on death certificates with information on long-term workers from personnel or union records (1), or with information on the longest-held job from interview or survey data (2,3) found agreement between occupation codes from death certificates compared with the alternate source from 65% to 68% of the time. Industry codes from the two sources matched from 67% to 70% of the time. Agreement was better for men than for women. While these agreement rates are lower than might be desired for hypothesis testing, they are generally adequate for surveillance purposes.

Since 1975, improvements have been made in the quality of industry and occupation (I/O) data collected on death certificates. A study of a national sample of death certificates in 1975 showed that 9% of the occupation entries and 19% of the industry entries did not contain enough information to assign a three-digit Census code (4). Improved data collection methods have resulted in an average of 2.8% incomplete occupation entries and 2.4% incomplete industry entries among death certificates from 16 states in 1984 (Table 1).

Data collection procedures are important because they can improve the quality and completeness of the I/O data collected from death certificates. Three procedures that have been implemented in some states are: training of funeral directors to collect complete and accurate I/O information; instituting query procedures for incomplete responses for I/O; and adding company name as a separate item on the death certificate.

Information on the decedent's usual occupation and industry is

obtained by the funeral director. It is important that the information is as detailed and accurate as possible. Funeral directors can be trained to collect better I/O information through the use of specially-designed courses given by state health department personnel on a periodic basis. In North Carolina, for example, a course was administered to all funeral directors in the state by state health department field personnel (5). Instructions for collecting complete I/O information were also added to the basic training program for new funeral directors in North Carolina. An educational publication, Guidelines for Reporting Occupation and Industry on Death Certificates (6), was partially funded by NIOSH and is available through NCHS. In addition, NCHS publishes a funeral director's handbook which provides additional guidelines (7).

Most state vital statistics offices have query procedures whereby funeral directors are notified if certain information on the death certificate is incomplete (e.g., name, sex, etc.). Some vital statistics offices have added industry and occupation to the list of items for which a query is issued if the response is incomplete. Responses that might be considered incomplete include "unknown," "retired," "disabled," and others. Some examples of query forms are given in Appendix B.

DATA PROCESSING

NIOSH recommends the use of the 1980 Census classification system for coding I/O entries from death certificates (8). Compared with other classification systems, the 1980 Census system is better for classifying the level of detail for industry and occupation that is typically provided by next of kin. Standardized training and quality control are available for coders using the Census system. Death certificate data coded according to the Census classification system will be compatible with similarly coded data from other states, as well as with data from the 1980 Census and national surveys. As these national data systems convert to the 1990 Census classification system, states will probably be advised to do the same.

Some states currently using the 1980 Census system have found that death certificates from previous years were coded using a different system, such as the 1970 Census system (9), the 1972 Standard Industrial Classification System (SIC) (10), or the Dictionary of Occupational Titles (11). Because these systems have limited compatibility with the 1980 Census system, it is difficult to combine data coded under the different systems. One approach is to group the data according to the coding system used, and perform separate analyses. Results from the separate analyses can usually be compared across broad I/O categories, and in some cases the detailed I/O categories are comparable from one system to another.

The 1980 Census classification system contains 503 unique occupation codes and 231 unique industry codes. An instruction manual is available for coder training (12), emphasizing the adaptation of the Census system for death certificates. Basic and advanced training courses are offered by NIOSH and NCHS for state coders (13). As of May 1989, coders from 43 state and territorial health departments have been trained in I/O coding (figure 1).

Quality control assistance for I/O coding is provided by NIOSH and NCHS to several states (14). Some states perform their own quality control. Typically, quality control for I/O coding consists of having a second coder perform a blind recode of a sample of death certificates. Then the two sets of codes are compared for differences. NIOSH has developed a computer program which compares the codes and prints any differences (15). This program could also be used by states desiring to do their own quality control. A third, more experienced, coder adjudicates the differences to determine which coder made the error. Error rates and lists of common errors are given to the coders to provide ongoing feedback.

Most experienced coders can be expected to have an error rate of 5% or less. Some examples of common errors are shown in Appendix C. Any errors detected during quality control should be corrected on the state's computerized death certificate file. If the error rate for a particular batch exceeds 7%, the entire batch should be recoded and corrected on the computer file. If the error rate is between 5% and 7%, the errors should be reviewed with the coder(s) so that corrective action can be taken with future batches.

Most data items used in occupational mortality surveillance undergo standard editing procedures under the NCHS Vital Statistics Cooperative Program (16). In addition, NIOSH has developed an I/O edit program which will check for invalid I/O codes and inconsistent combinations of I/O codes (17). This program is based on information provided by the Census Bureau on inconsistent code combinations (Appendix D). All errors detected during editing should be resolved by referring back to the death certificate. Additional queries may be necessary to obtain complete information. Certificates with incomplete information on age, race, sex, or cause of death must be excluded from analyses. Certificates with incomplete information on occupation or industry may or may not be excluded from analyses, depending on the type of analysis.

Certain I/O codes can be imputed when one code is known (usually occupation) and the other code (usually industry) is either missing or "retired". The Census Bureau provides a list of codes that fall into this category (Appendix E). Since the Census imputation list was developed for use with the 1980 U.S. Census, the suggested imputations may not always be appropriate for I/O data gathered from state death certificates. We have developed a method at NIOSH for adapting the Census list for use with death certificate data. This method is described in Appendix E, along with some examples.

ANALYSIS

Methods for Screening the data

In most occupational mortality surveillance systems, it is desirable to screen the data periodically to identify trends or to generate new hypotheses about associations between occupation and disease. Various methods have been used by NIOSH and state health departments to screen the data. Several surveillance reports have been published by the states (18-28). Each state must make decisions about the study population, the exposure and disease categories, types of adjustment, and the statistics used. These topics will be discussed below in more detail.

Study Population

Most states must combine data from several years to increase the size of the study population to permit meaningful analysis. The number of years combined varies from state to state. For example, Washington combined data for the years 1950-1979 to obtain a total of 429,926 white male deaths (26). Pennsylvania, on the other hand, combined only three years of data to obtain over 150,000 deaths for white males (22).

Some states include only resident deaths occurring in-state. Other states include non-resident deaths and/or deaths occurring out-of-state. NIOSH often combines resident, in-state deaths from several states into geographic regions for analysis purposes. States might also consider combining data with neighboring states in order to increase the size of the study population.

Analyses are usually restricted to persons over age 15 or 20, and a few states further restrict their data with an upper age limit of 65 or 75. Restrictions on age have the effect of eliminating retired persons from the analysis. Such restrictions also may effectively eliminate certain chronic diseases from the analysis. There are several reasons for setting an upper age limit: (1) the quality of the I/O data on death certificates for retired persons is thought by some researchers to be poor (29); (2) there may be a desire to focus on premature death; or (3) the statistic used in the analysis (e.g. standardized mortality ratio) may require employment data to estimate the denominator, or population at risk, and employment data are limited for persons over age 65. NIOSH performs separate analyses for persons in different age groups (e.g. 18-64, 65+), so that results for the different age groups can be compared.

Separate analyses are usually performed according to race and sex. If the non-white population is too small to perform a separate analysis, some states drop minorities from the analysis, while some combine minorities with the white population. For

example, Washington state, with only 3% non-white deaths, excludes non-whites from their analyses (26). In upstate New York (excluding New York City), where 7% of the deaths occur among non-whites, data are combined for whites and non-whites (21).

Disease and Exposure Categories

Most states combine the specific, cause-of-death codes into broader categories for analysis purposes. The frequencies of the specific causes of death, the size of the dataset, and the change in disease rates over time are the primary factors to be considered in selecting cause-of-death categories. Usually, several broad categories, such as "all cancers" or "all heart disease," are analyzed, as well as those detailed categories having an adequate sample size (see **Statistical Inference**, below). Diseases with similar etiologies can be combined to provide the frequencies needed. Diseases whose patterns have changed differentially over time should probably not be combined. Appendix F lists the detailed cause-of-death categories used by NIOSH for the analysis of large data sets. Appendix G shows a shorter list used with smaller data sets.

Separate analyses are usually performed for occupation and for industry. The 1980 Bureau of the Census coding system is set up so that similar occupations and similar industries are grouped together. Broad occupation or industry groups can be formed by collapsing the appropriate contiguous detailed categories. Other methods for grouping occupation and industry include defining different categories for males and females (because of different employment patterns), and combining industry with occupation. Appendix H shows detailed groupings of occupations and industries used by NIOSH for large datasets. Appendix I shows broader groupings used with smaller datasets.

Additional effort is required to define categories of occupations or industries which are homogeneous with respect to exposure. One approach is to use information from a job exposure matrix (JEM) to define I/O categories (30). The typical JEM is a computerized database containing information on workplace hazards (e.g., chemical exposures) and the occupations and industries where exposure to those hazards may occur. Attempts to use JEMs to define I/O categories have met with varying levels of success (30-34), and more work needs to be done in this area. NIOSH has developed a JEM using data from the National Occupational Hazard Survey (35). The NIOSH JEM can be made available to the states by contacting the appropriate NIOSH staff member listed in the reference section (35).

Adjustment factors

Statistical adjustment is an analytic method used to take into

account differences between the occupation group under study and the comparison group with respect to certain factors that may be related to disease. Age is the most commonly used factor for adjustment, but some states also adjust for other factors like race or year of death. The way in which the adjustment is calculated depends on the statistic used to estimate risk (see **Estimates of Risk**, below). Adjustment can be made indirectly for factors not reported on the death certificate, such as tobacco use, by using an external source of information on the distribution of the factor according to occupation and/or industry (27, 36-38).

Another way to account for differences between occupation and comparison groups with respect to important risk factors is to perform separate analyses for different risk categories. For example, separate analyses might be performed for the subset of all white collar or all blue collar workers, as a way of comparing each occupation or industry to other workers in similar social classes.

Estimates of Risk

The typical screening analysis produces an estimate of risk for each I/O category with respect to each cause of death category. The three most commonly used estimates of risk for occupational mortality surveillance are the Standardized Mortality Ratio (SMR), the Proportionate Mortality Ratio (PMR), and the Standardized Mortality Odds Ratio (SMOR) (figure 2). A PMR or SMR greater than 100, or an SMOR greater than 1.0, indicates an excess risk, while a PMR/SMR less than 100, or an SMOR less than 1.0, indicates a decreased risk of disease for the occupation under study. A number of papers compare the different methods (39-44). This document will provide a brief description of each method, highlighting the advantages and disadvantages with respect to the other methods.

Standardized Mortality Ratio (SMR)

The SMR is the ratio of the number of observed deaths for a particular cause in an occupation or industry group to the expected number of deaths based on the mortality rate for that cause in a standard population (40). For purposes of occupational mortality surveillance, the entire population usually serves as the standard population, and the indirect method of standardization is used (40). To compute SMRs the population at risk must be known, that is the number of individuals in the population in each occupation and industry group by age, sex, race and any other variable for which it is necessary to adjust. For death certificate studies in the United States, this information is usually obtained from the decennial Censuses, which provide information on current industry and occupation for a 20% sample of the population.

While the SMR is statistically a better estimator of the relative risk than the other methods (39), the application of the methodology has met with limited success in the United States. This is explained partly by the difficulty in obtaining detailed and accurate data on the population at risk. Census data provide a measure of the current occupation and industry of the population surveyed, while death certificates request the usual occupation and industry for decedents. This can result in misclassification of the population at risk (40, 45). Furthermore, Census data are obtained every 10 years, which leads to the problem of obtaining estimates for inter-censal years.

Inadequate denominator data can lead to several problems. The misclassification in the denominator resulting from the lack of data on the usual occupation and industry of the population at risk causes systematic errors. The underestimation of the number in an occupation group results in inflated SMRs, while overestimation causes deflated SMRs. Since the number of persons employed falls rapidly after age 64, data on occupation and industry for persons over age 64 are unavailable through the Census. Deaths occurring in persons over 64 cannot be analyzed using the Census data, which means the loss of over half the deaths.

Surveillance studies using SMRs have been done in California (18), Rhode Island (23), Great Britain (40), and the United States (46). North Carolina recently published results of a study in which a variation of the SMR, with direct adjustment, was used (28).

Proportionate Mortality Ratio (PMR)

The PMR compares the observed number of deaths for a particular cause in an occupation or industry group with the expected number of deaths from that cause, based on the proportion of all deaths due to that cause in a standard population (40). The standard population usually used in occupational mortality surveillance studies is the total population of decedents in the study. The PMR uses the indirect method of standardization (40).

The PMR analysis is the easiest of the three, which is its main advantage. Data on the population at risk are not required. The computer programming is relatively simple for two reasons. First, each specific occupation or industry is usually compared to the total population rather than to "all other occupations" or to some group of "non-exposed" occupations. Second, the standard population usually includes all causes of death rather than a set of auxiliary causes specific to each cause being analyzed.

The PMR method requires the assumption that the all-cause, or total, mortality rate is the same for both the exposure group

(i.e., occupation) under study and the comparison group (i.e., the all-cause SMR=100) (39). If the all-cause SMR for an industry or occupation is greater than 100, the PMRs tend to underestimate the true risk. That is, they may not detect all real associations. If the all-cause SMR is less than 100, the PMRs tend to overestimate the true risk and may produce "false positives."

Another problem is that the PMR for each particular cause of death is dependent on the PMRs for the other causes in a particular occupation or industry. This can be especially important if the occupation under study has relatively high or relatively low mortality due to some common cause. If the PMR for the common cause of death is high, the PMRs for other causes are artificially deflated. Conversely, if the PMR for the common cause is low, the PMRs for other causes are artificially inflated.

One way to avoid the problem of PMRs being influenced by PMRs for common causes is to exclude the common causes from the analysis (40, 47). For example, McDowall (47) found that male administrators and managers had a PMR for cancer of the pancreas of 129, and a PMR for ischemic heart disease, a common cause of death, of 120. When the deaths were reanalyzed excluding the ischemic heart disease deaths, the PMR for cancer of the pancreas increased to 145. The high PMR for ischemic heart disease was effectively reducing the PMR for cancer of the pancreas.

Most of the published state-based surveillance studies have used PMRs (20-26). NIOSH has developed a PMR computer program designed for surveillance studies (48).

Standardized Mortality Odds Ratio (SMOR)

The SMOR has been suggested as an alternative to the PMR when denominator data are not available (41). The SMOR is the ratio of the mortality odds between the occupation of interest and a non-exposed comparison group. The mortality odds for the cause of interest is computed relative to a comparison group of auxiliary causes. The SMOR is adjusted by using the indirect method of standardization. The SMOR differs from the Mantel-Haenszel Odds Ratio (MHOR) in the method of weighting (49). Unlike the MHOR, the SMOR does not require the assumption of homogeneous odds ratios across the strata (49). The SMOR, however, requires larger frequencies in each stratum (i.e., few counts under 5) compared to the MHOR (49).

Compared to the PMR, the SMOR requires the more easily satisfied assumption that the mortality rate for the auxiliary causes of death is the same for the occupation under study as for the comparison group (41). This can usually be achieved by selecting auxiliary causes that are not related, either directly or

indirectly, to an occupational exposure. For example, in a study of cancer risks in the optical manufacturing industry by Wang, et al., cardiovascular disease was chosen as the auxiliary cause, because it was not thought to be related to the types of exposures present in the optical manufacturing industry or in the comparison industries (50).

Because the auxiliary causes may change for each comparison, the computer programming necessary for a large series of comparisons can be very complex. The SMOR is a useful method of analysis when examining a small number of occupations and causes of death. Death certificate surveillance studies using SMORs have been described by Dubrow and Wegman (27) and by Wang, et. al. (50).

Statistical Inference

Various methods can be used to determine whether the risk ratio is statistically significantly greater than or less than unity. For PMRs and SMRs, most states use the Mantel-Haenszel adjusted chi-square (51) (or an exact test based on the Poisson distribution (52)) for comparing an observed number to its expected value. For the SMOR, inference is usually based on the Mantel-Haenszel Odds Ratio (MHOR) (51), including various methods which have been derived for estimating the variance and confidence intervals of the MHOR (53-57).

To assure the validity of the chi-square and other statistics, most states require some minimum number of observed or expected deaths for each combination of occupation or industry and cause of death. The usual method is to require a minimum of five expected deaths (58). Mantel and Fleiss have developed a statistical method for determining the minimum expected cell size for the Mantel-Haenszel chi-square (59). Otherwise, the choice of an appropriate minimum appears to be somewhat arbitrary.

In most surveillance studies, an alpha of .05 is used to construct a two-sided test for significance. Even though many estimates are being tested simultaneously, few states use statistical methods to compensate for multiple comparisons. Most states use the alpha level as a tool for narrowing the focus to a small number of PMRs, SMRs, or SMORs that should be followed-up with more rigorous epidemiologic and statistical evaluation.

Interpreting Results

Given the many PMRs, SMRs, or SMORs that are produced in a surveillance study, additional tools are needed to aid in interpretation. The analyst would like to focus on those associations that are most likely to be cause-effect relationships and to disregard those that are probably spurious associations.

One useful approach, outlined by Hill (60), suggests a number of areas that should be considered:

(1) the strength of the association - a risk ratio of 10 to 1 is more difficult to attribute to some confounder than a ratio of 2 to 1;

(2) consistency - do the results agree with other studies;

(3) specificity - is the result limited to a specific disease in specific workers, with no associations with other diseases;

(4) the relationship in time - for example, is the disease a result of something in the work environment, or are persons who are prone to the disease more likely to engage in that type of work;

(5) presence of a biological gradient, or dose-response curve;

(6) biological plausibility;

(7) coherence - does the result conflict with known facts of the natural history and biology of the disease;

(8) experimental evidence - do preventive measures affect the association over time; and

(9) analogy - have the results been found in other occupations with similar exposures.

NIOSH has used these principles to evaluate and interpret results from PMR studies of data from several states (61, 62).

NIOSH has developed or is developing various tools that can aid in interpreting results. These can be made available to the states by contacting the appropriate NIOSH staff member listed in the reference section. The NIOSH Job Exposure Matrix can be used to link occupational codes with hazardous agents to which persons in those occupations are likely to be exposed (35). In addition, NIOSH maintains a comprehensive bibliographic database called NIOSHTIC, which emphasizes the occupational safety and health literature (63). A third database maintained by NIOSH, called RTECS (Registry of Toxic Effects of Chemical Substances), provides basic information on the known toxic and biological effects of chemical substances (64, 65). A computer-based retrieval system for results from occupational mortality surveillance studies is in the early stages of development (66). When completed, this system will facilitate access to and comparison of the results of the various studies.

Follow-up Studies

Follow-up studies are usually done to investigate further a finding or hypothesis generated by the initial PMR/SMR/SMOR analysis. The purpose of the follow-up study is to try to validate the original finding using the same data in a refined analysis or by analyzing new data or both. The follow-up study is usually designed after the initial hypothesis has been evaluated together with the results of other surveillance studies or other research findings, if available.

There are several kinds of follow-up studies. Some of these are described below, including refined PMR analyses, case-control studies, and geographic or trend analyses. Validation procedures for industry and occupation codes are also discussed.

Validation Procedures

To increase the precision of follow-up studies using death certificates, it may be useful to perform further editing of the data, particularly the industry and occupation codes. Systematic coding errors can sometimes lead to spurious associations. Several steps can be taken to test the accuracy of the I/O coding. Listing occupations within industries may make evident systematic coding errors. If an occupation has been frequently coded within an industry where it would not be expected (for example, underwriters coded to some industry other than insurance), either the industry or the occupation may be coded incorrectly. This is likely to happen with a large company that could have more than one industry code.

If it is possible to retrieve the death certificates, a sample of the certificates of interest could be recoded and the accuracy of the coding evaluated. If the quality is poor, all certificates of interest could be recoded. Also, if there is a high percentage of "not elsewhere classified" types of occupation or industry codes, it might be desirable to have these recoded. Special codes could be added, if necessary, to classify the occupations and industries more specifically than possible within the Census coding system. For instance, Rhode Island added more specific codes for the jewelry industry and its occupations (23).

Refined PMR Analyses

More refined PMR analyses using death certificates can be done for groups of particular interest, if sample size permits. This could be a first follow-up to hypotheses generated by the initial analysis. Preferably the data would be further edited as described above. More detailed information on the industry, occupation, cause of death, or other factors might be retrieved from the death certificates to further refine the analysis.

There are several ways in which the initial analysis could be revised to learn more about the potential association. Examples of refinements over the initial analysis include blue collar- or white collar-specific analyses or occupation within industry analyses. If the occupation or industry group of interest has a cause of death with a particularly high or low rate, which could affect the PMRs of other causes of death, the PMR analysis could be repeated with this cause of death removed. An example of this would be pneumoconiosis in coal miners. Studies by Dubrow and others, showing some of these methods, are listed in the reference section (67-71).

Case-Control Studies

Death certificate-based case-control studies are an intermediate step between the general mortality surveillance and field investigations to evaluate the relative risks. Death certificate statements, regarding occupation and industry of decedents who died from a specific cause of interest, can be compared to those of a control group who died of other selected causes or all other causes. Variables in the case-control study that might be used for matching or adjustment are sex, race, age, or county of residence. Initial hypotheses substantiated by such analyses would be prime candidates for further study. See the reference section for studies of this type (72-75).

Geographic or Trend Analyses

Other follow-up studies may include geographic or trend analyses. Trends in causes of death may vary by geographic locale or over time. If the data range over several years or contain rates or ratios at the county level, a trend analysis may be done as a follow-up study. The purpose of trend analysis is to assess variation in rates over time or place. Mortality rates or other statistics may be compared across counties and over time. Not all causes will lend themselves to this type of analysis, because the smaller geographic areas and shorter time frames lead to small numbers of deaths. Trend analyses may be especially useful for describing a new hypothesis or excess cause of death. This additional information can help in the design of a more detailed study. Some examples of geographic and trend analyses are listed in the reference section (25, 76-78).

Applying the SHE(O) method to death certificates

Occupational mortality data can be used to monitor occupational sentinel health events, or SHE(O)s. Rutstein et. al. published a list of SHE(O) disease rubrics, or categories, in 1983 (79). They defined a SHE(O) as "a disease, disability, or untimely death which is occupationally related and whose occurrence may: (1) provide the impetus for epidemiologic or industrial hygiene

studies; or (2) serve as a warning signal that materials substitution, engineering control, personal protection, or medical care may be required".

Several states are using the SHE(O) list to aid reporting and follow-up of occupationally-related disease (80). The SHE(O) list can also be used as a framework for monitoring deaths that may be occupationally related (19, 81-82). There are two types of SHE(O)s in the list: (1) inherently occupational SHE(O)s, such as coalworkers' pneumoconiosis, which are known to be occupationally related; and (2) non-inherently occupational SHE(O)s, such as lung cancer, which may not always be caused by occupational exposures. The first type can be identified by the ICD code for the cause of death, while the second type is identified by the ICD code and the associated industry or occupation.

NIOSH has developed a computer program which can be used to identify death certificates matching the criteria on the SHE(O) list (83). Certificates flagged by the program can then be reviewed to see if some type of follow-up is warranted. Other uses of the SHE(O) list include: (1) a way to focus the review of results from the screening analysis; and (2) monitoring trends in occupational mortality over time and space.

SUMMARY

This report has presented an overview of a variety of methods, particularly in the area of data analysis. The reader should consult the references given for more detailed discussions of these methods. In most cases, there is no right or wrong technique. The availability of resources, professional expertise, and state commitment to occupational mortality surveillance will vary from state to state and will dictate, to some extent, the methods used. For states planning to begin a program of occupational mortality surveillance, consultation with NIOSH and state contact persons can be helpful in narrowing the focus and providing some direction to program development.

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14. I/O quality control assistance. NIOSH contact is Lois Schuster, Illness Effects Section, NIOSH, 4676 Columbia Parkway, Mail Stop R18, Cincinnati, Ohio 45226. (513) 841-4332. NCHS contact is Lacola Washington, NCHS, P.O. Box 12214, Research Triangle Park, North Carolina 27709. (919) 541-0988.

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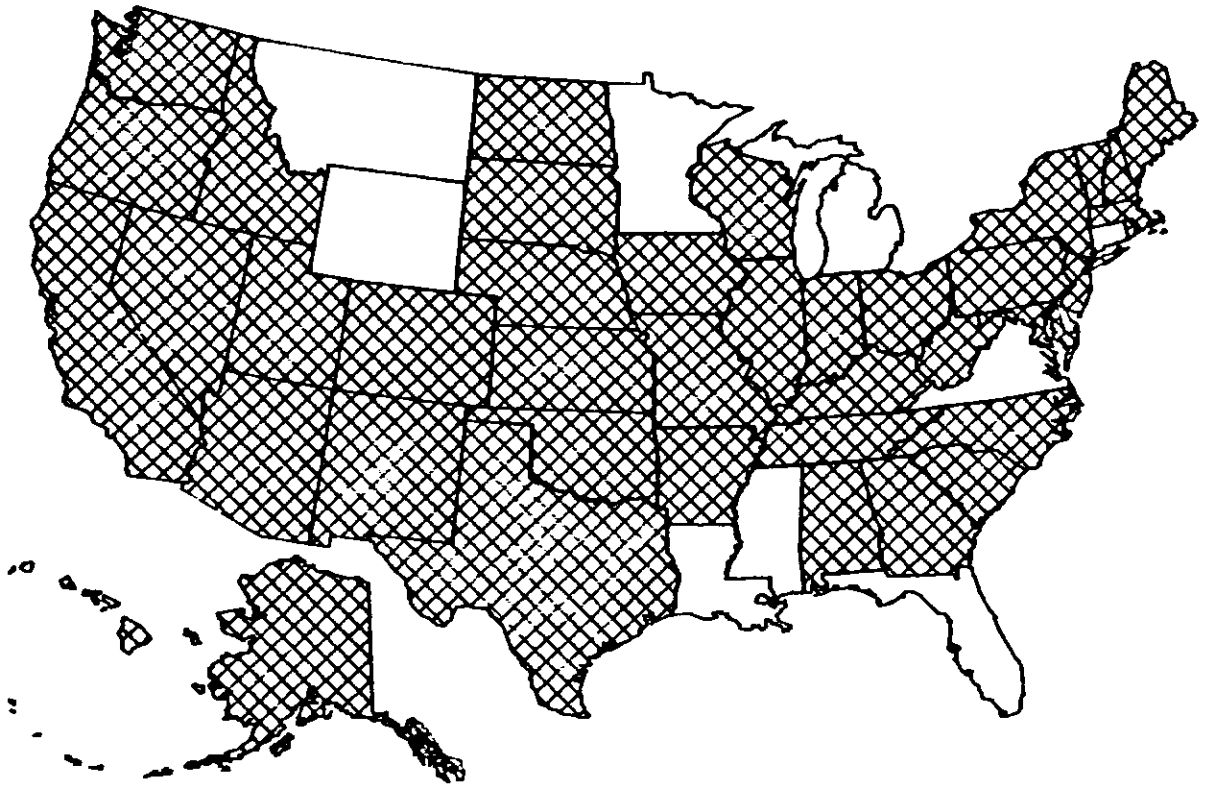
Table 1.
Percent of Incomplete Entries for I/O*, by State, 1984.

State	Percent of Incomplete Entries	
	Industry	Occupation
Colorado	3.6	3.5
Georgia	0.6	0.8
Kansas	0.9	1.7
Kentucky	7.3	8.1
Maine	2.1	1.4
Missouri	1.7	1.3
Nebraska	0.6	0.4
Nevada	3.9	2.3
New Hampshire	1.2	1.4
New York	1.9	1.5
North Carolina	4.5	5.8
Oklahoma	10.0	8.6
Pennsylvania	5.9	5.0
Rhode Island	2.4	2.3
South Carolina	0.3	0.3
Wisconsin	1.0	0.9
Average	2.4	2.8

* Coded as Unknown or Retired

STATES TRAINED IN I/O CODING

MAY 1989



Also Trained: Washington, D.C., New York City, and Puerto Rico

FIGURE 1

Figure 2 - Methods for Estimating Risk

For the ith stratum:

	Occupation or Industry of Interest	All Others	Total
Cause of Death of Interest	a_i	b_i	M_{1i}
All Other Deaths	c_i	d_i	M_{0i}
All Deaths	N_{1i}	N_{0i}	T_i
Population at Risk	P_{1i}	P_{0i}	P_i

$$SMR = \frac{\Sigma\ a_i}{\Sigma\ P_{1i}\ (\frac{M_{1i}}{P_i})} \times 100$$

$$PMR = \frac{\Sigma\ a_i}{\Sigma\ N_{1i}\ (\frac{M_{1i}}{T_i})} \times 100$$

$$SMOR = \frac{\Sigma\ a_i}{\Sigma\ \frac{b_i c_i}{d_i}} \times 100$$

Appendix A - State Resource People for Occupational Mortality Surveillance

Gwendolyn Doebbert
Chief, Health Demographics Section
California Department of Health Services
714 P. Street; Room 1479
Sacramento, CA 94814
(916) 445-1010

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Division of Health Statistics and Research
Massachusetts Department of Public Health
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Boston, MA 02111
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Pennsylvania Department of Health
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Providence, RI 02908

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Director, Bureau of Health Statistics
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Salt Lake City, Utah 84110

Samuel Milham, Jr., M.D.
Division of Health
ET-13 Department of Social and Health Services
Olympia, Washington 98504-0095

Raymond D. Nashold, Ph.D.
Director, Center for Health Statistics
1 West Wilson, Room 172
Madison, Wisconsin 53702
(608) 266-1334

Appendix B - Examples of Query Forms

...s G. Ledbetter, Ph.D./Commissioner

47 TRINITY AVENUE, S.W. / ATLANTA, GEORGIA 30334-1202

Date Sent _____

DEATH CERTIFICATE INDUSTRY AND OCCUPATION QUERY LETTER

DEAR REGISTRAR:

The _____ on this certificate is incomplete. The industry is the kind of activity at a person's place of work, such as, Shoe Stores, Hotels, Banks, Hospitals, Construction Company, Furniture Manufacturing, Farming, Restuarants, Army, Navy, etc.

The occupation refers to the kind of work a person did at his or her place of work for most of his or her working life. Some of these are Bakers, Carpenters, Bank Tellers, Civil Engineers, Secretaries, Farmers, Machine Operators, Doctors, Army Sergeant, etc.

Please return the attached certificate with the correct information as soon as possible to enable us to process and file the certificate.

Thanking you in advance, for your full cooperation.

VITAL RECORDS SERVICE

Mrs. Annette Anderson
Registration Unit

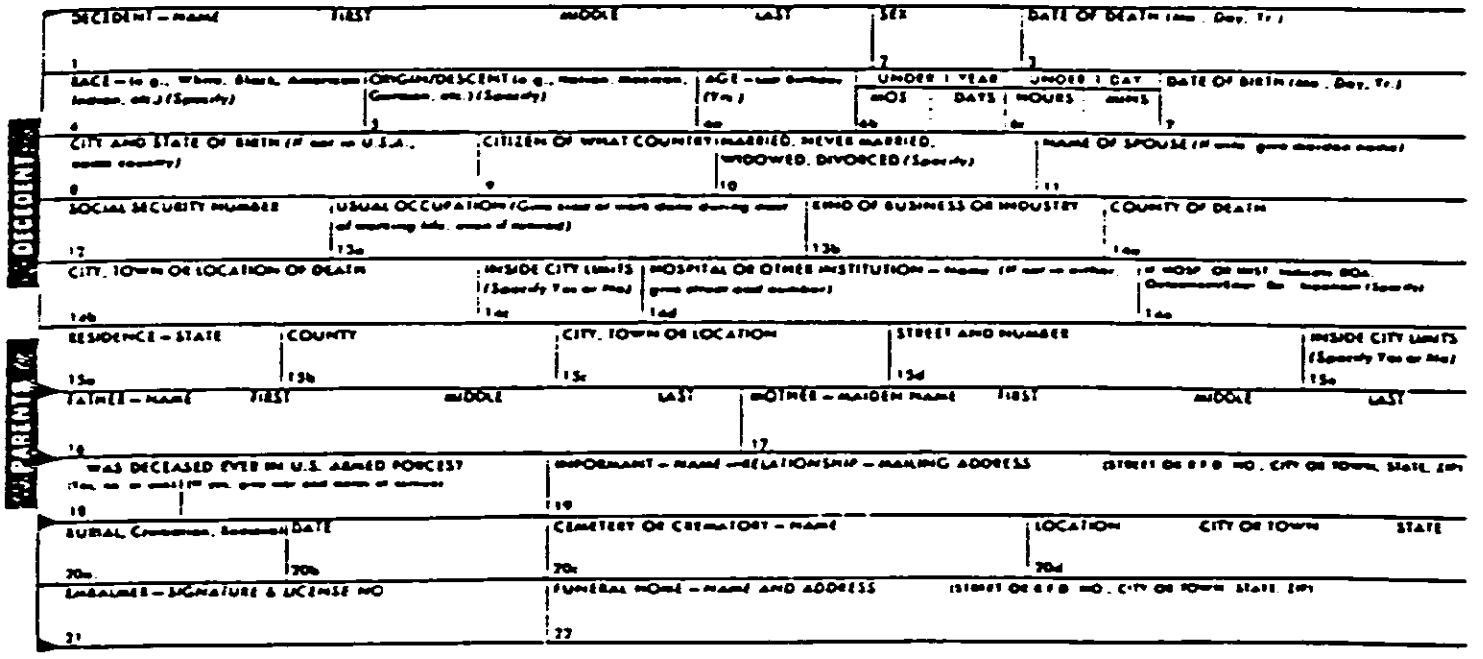
STATE OF NEBRASKA

DEPARTMENT OF HEALTH

KAY A. ORR
GOVERNOR

GREGG F. WRIGHT, M.D., M.Ed.
DIRECTOR

Please complete/verify the items checked in red or state "unknown".



The item above is queried since the occupation and industry could not be adequately matched with our guide on industry and occupation. Coding of the occupation and industry in Nebraska and nationally provides statistics which have been instrumental to Health agencies in focusing on health care needs. Past and ongoing research using this information resulted in decreased death rates. Your assistance is appreciated.

BVS-2C
REV 4/83
020-81-007

Please direct reply to _____

_____
(Signature)

DEPARTMENT OF HEALTH, BUREAU OF VITAL STATISTICS,
301 CENTENNIAL MALL SOUTH, BOX 95007, LINCOLN, NEBRASKA 68509-5007, PHONE (402) 471-2871
AN EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER

NC DEPARTMENT OF HUMAN RESOURCES
DIVISION OF HEALTH SERVICES
VITAL RECORDS BRANCH
RALEIGH, N.C.

Occupation & Industry Query

County_____ Date_____

Dear Deputy Registrar:

The occupation and/or industry entries on the death certificates for the persons listed below are not acceptable because the information provided is not specific. The following error codes indicate why the entries are not acceptable:

1 = An Unspecific Industry
2 = An Unspecific Occupation
3 = Company's Name
4 = Industry Blank
5 = Occupation Blank

Please enter the corrected information beside each name, and return as soon as possible in the provided envelope.

Certificate Number	Name	Date of Death	Error Code	Corrected Entries
_____	_____	_____	_____	O:_____
				I:_____
_____	_____	_____	_____	O:_____
				I:_____
_____	_____	_____	_____	O:_____
				I:_____
_____	_____	_____	_____	O:_____
				I:_____
_____	_____	_____	_____	O:_____
				I:_____

DHS 3273 (11/84)
Vital Records

Signature_____

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
OFFICE OF VITAL RECORDS AND PUBLIC HEALTH STATISTICS

COLCM-3 INQUIRY FOR DEATH INFORMATION 06/01/87
PAGE 1

CUNTY:
ILITY:

NAME OF DECEDENT:
STATE FILE NUMBER:
DATE OF DEATH:

OR MESSAGE(S)

USUAL OCCUPATION AS REPORTED: ~~913~~ Retired

PROBLEM: INVALID OCCUPATION - RETIRED OR NO INFORMATION

CORRECT INFORMATION: ____ _____

See attached #5

IND OF BUSINESS OR INDUSTRY AS REPORTED: 951 Retired

PROBLEM: INVALID INDUSTRY - RETIRED OR NO INFORMATION

CORRECT INFORMATION: _____ _____

SIGNATURE: _____ TITLE: _____

DATE: _____

* PLEASE REPLY WITHIN 10 DAYS OF RECEIPT

The paragraph(s) checked below will clarify or explain the information needed to complete the item(s) in question on the attached query form.

PLEASE ENTER INFORMATION ON THE QUERY FORM

1. ☐ Place of death should be same as information in items 28f and 28g unless the fact of death was not determined prior to removal to the hospital.

2. ☐ Place of death, county, city and address and the residence information must be the same if death occurred at home.

3. ☐ Patient status should be omitted if death occurred at a residence, on the highway, at a physician's office, etc.

4. ☐ Patient status must be completed if death occurred in a hospital, institution or nursing home.

5. ☐ Retired is not an acceptable entry. Enter usual occupation while employed.

6. ☐ Laborer is not an acceptable entry. Enter usual type of labor done and place employed.

7. ☐ None is not an acceptable entry for occupation and/or industry. Enter usual occupation and industry, while employed. If never employed enter "Never Employed" in occupation.

8. ☐ Unemployed is not an acceptable entry. Enter usual occupation when employed and usual type of industry.

9. ☐ Rather than providing name of business or company, enter <u>type</u> of business or company.

10. ☐ Disabled entire life, yes/no? If disabled entire life, enter never employed. If not disabled entire life, enter occupation and industry when employed.

11. ☐ Occupation is not reported for type of industry given. Please give occupation or type of work.

12. ☐ Industry or type of business not reported for occupation given. Please give type of industry.

13. ☐ Residence information must be same as nursing home or institution where death occurred if it is a long term care facility or institution where persons normally stay for long periods of time. Length of stay does not matter.

14. ☐ Residence information must be actual location of residence and is not necessarily the same as mailing address.

15. ☐ Do not give a post office box number or general delivery in this item. Name of street or highway or state road is acceptable with rural route and box number. Name of community is also acceptable.

16. ☐ Our information indicates address is (inside/outside) city.

17. ☐ Is residence address inside or outside city limits?

18. ☐ Inside the city limits of_____cannot be in_____County.

Appendix C - Common Coding Errors

1. Occupation entry of machine operator, not specified, is coded to 779 (machine operator, not specified) instead of 777 (misc. machine operator, not elsewhere classified) when industry is a manufacturing code.

2. Occupation entry of laborer is coded to 889 (laborers, except construction) instead of 869 (construction laborers) when industry is coded to construction.

3. Occupation entry is one which has a center industry in parentheses and industry entry is retired and is coded to 951 (retired) instead of the industry suggested in parentheses.

4. Industry entry is school and is coded L (elementary and secondary schools) instead of 961 (homemaker, student, etc.) and occupation is student and is coded to N (elementary teachers) or P (secondary teachers) instead of 915 (student).

5. Industry entry is wholesale, not specified, and is coded to 990 (not reported) instead of 571 (not specified wholesale trade).

6. Industry entry is retail, not specified, and is coded to 990 (not reported) instead of 691 (not specified retail trade).

7. Industry and occupation entries are none and are coded to 990 (not reported) and 999 (not reported), respectively, instead of 961 (homemaker, etc.) and 917 (unemployed).

8. Industry does not indicate whether it is manufacturing, wholesale, or retail and is coded to manufacturing instead of wholesale or retail, even though the occupation indicates sales.

9. Industry entry is a specific branch of the armed forces, and the occupation entry is a possible civilian occupation coded to 942 (military) and 905 (military), respectively, instead of 932 (national security and international affairs) and the applicable civilian occupation code.

Appendix D - Inconsistent Occupation and Industry Codes

The following occupation and industry code combinations are inconsistent.

Occupation	Industry
029	551
033	500-691
277	171
356	412
376	711
433-444,468,748	761
759	060
777,779	040-050
799	010-020
889	060

If the following occupation codes do not fall within the indicated industry codes, the codes are inconsistent.

Occupation	Industry
003	900-932
004	900-932
005	60,400,412,870,871,840,900-932
006	412,900-932
014	832-932
015	812-932
017	412
018	781
024	710,711
028	010-031,100-130,550,551,601-611,641,762,932
029	500-550,552-691
034	440,721-742,800-802,892
035	060,700-712,900-932
043	021,060,580-691,712,742,842-860,882,900-932
044	352,362,371,421,882,891,900-932
045	040,192,200,270-301,392,400,730,882,891
046	040-050,882,891
047	042,200,422,552,882,891
048	042,100-392,400,760,882,891
053	040-050,060,400-472,840,882,891,900-932
058	031,360,420,432,882,891,900-932
063	040-050,400,882,900-932
075	040-060,200,460-472,552,721-742,882,891,892,900-932

Occupation	Industry
077	010-031,100-130,160-162,730,850-860,891,900-932
079	010-031,160-162,230-241,891,900-932
084	812-932
085	820-840
086	010-031,900-932
087	682,812-840
088	812-840
089	812-840
095	731,761,812-932
096	181,541,642,812-840
097	100-122,641,831-840,842-932
114-154	850-851
155	842,862
156	842
157	842
158	842-870
163	842-932
164	440,831-852
174	831-932
176	831,880
177	830,871-881
179	841,900-932
183	171-172,352,362,400-440,800-802,892
187	400-441,721,800-802
195	171-172,440,721,742,800-932
199	011,551,742,801-802,842,850,881
203	812-840
204	820
205	812-840
206	812-840
207	731,761,812-860
218	040-060,400-460,712,742,882,900-932
227	421,931,932
234	700-712,841,900-932
253	700-712
254	700-712,900-932
255	700-710
256	171,172,440-442,721,732,890
257	020,021,060,171-172,400-472,722-760,762,770,771,800,841,882-932
259	010,011,030-050,100-162,180-392,500-571,900-932
263	500-691,750-752,760,790,900-932
264	530,541,580-691,750-752,760,790,900-932
265,266	580-691,750-752,760,790,900-932

Occupation	Industry
267	460,580-691,750-752,760,790,900-932
268	580-691,750-752,760,790,900-932
269	500-691,750-752
274	432,442,552,580-691,712,731,742,761,771-782791,801-840,842,881,900-932
275	500-691,750-802
278	171,671
317	712,762,770
318	400-432,614,762,831,881,900-932
325	171,441
329	171,172,842-852
349	400-442,700-742
354	412
355	412
366	460-472
375	401-432,711-751
383	432,700-702,800-802
387	842-870,922
403	761
404	761
405	761
406	761
407	761
413	030,230,910
414	900-932
416	030,100-392,711,910
417	030,360,421,910,932
418	412,900-921
423	412,900-932
424	901,910,932
425	400,401,910
434	400,641,762,800-802,881
435	400-401,591-642,762,800-802,831-892
438	400,420,601,641,642,762,831,842
439	601,641-642,762,770,831-840
445	820
455	020,060,191,471,722
457	772,780,831,851
458	440,591,682,772,780,791,800,851
459	401,420,762,770,800-802
464	800-872
465	400-411,420-432
467	812-932
468	770-880
473	010-020
474	010-020
475	010-020

Occupation	Industry
476	010-020
477	010-020
479	010-020
483	010-031
484	010-021,561,681
488	010-020,551,561,681
489	010-031,550
494	030,230-232
495	030
496	010-050,100-392,460-462,580
497	031,802
498	031,802,872,910
508	352,362,421,900-932
514	351,401,500,590,612-622,750,751
515	352,362,421,900-932
517	311,530-582,760
527	400-401,441-462
529	341,400-401,441,442,741
553	060,250-262
555	060,100-392,400,460-462
556	060,360,721
557	042,060,360
563-564	040-060,251-301,682
565	060,580,632,760
566	060,591,632,760,771
573	060,231-232
577	060,400-472
583	060,721
584	060,251
588	060,251,360,632
593	060,200,262,340-361,500-581
594	060
595	060
597	040-042,060,270-370,392,400-432,651,760
598	040-060,460-462
613	040-050
614	040-050
615	040-392
616	040-060
617	040-050
634	100-392,400,760
635	100-392,400,760
644	100-392,400,760
646	210-392,400,760
647	320-392,511,532,561,562,591,660,760
649	132-390
653	010-571,750-760
654	010-571,750-760

Occupation	Industry
656	100-392
658	060,231-242,591-640,760
659	241-391
667	132-151,542,591,630,661,691,771,791
669	220-222,542,631,760,782
673	132-221
674	100-391,440,630,662,771,800
675	050,100-392,400,651-682,760
676	161-432
678	372,820,840
683	340-391
686	100-122,411,500-691
687	111,121-122,601,610,831
688	100-122
693	100-392
694	132,392,461-471,901
695	060-391,401,460-462,831-850
703	100-392,400,760
704	100-392,400,590,612-622,750,751,760
705	100-392,400,760
706	020,100-532,760,771
707	210-392,400,760
708	100-392
713	242-392,400,760
715	100-392,400,760
719	100-392,400,760
723	100-392,400,760
724	100-392,400,760
725	100-392,400,511,531,752,760
726	100-392
727	020-050,100-392,400,760
728	160,231-242
729	060,100-392,400-422
735	171,172,380,742,781,791,800
736	171,172
738	132-161,180,210-220,331
739	132-152,180,372
743	100-392,760
744	100-400,580-691,760-771,831-881
745	211,212
747	132-152,221,771
748	151,762-791,831-850
749	100-392,580-691
753	100-392
756	060-392,400,611,760
757	010-392,400,561,760
758	020-039
763	011,100-392

Occupation	Industry
764	100-392
765	100-392
768	040-392,400,530,551,561,600,672, 682,760,822
773	800
823	040-050,100-401,500
824	040-050,100-401,500, 760
825	040-050,270,400-401
826	400-401
828-829	060,420-432,761,762,802
845	420
865	060,152,270-370,460,682
867	040-050
869	060,400-472
875	410,471,901
876	420
878	100-392

Appendix E - I/O Codes which can be imputed and method for imputing

If the industry codes are not reported for the following occupation codes, the industry codes may be imputed as indicated.

Occupation Code	Imputed Industry Code
003	900
004	900
006	910
015	831
016	712
017	412
018	781
028	551
029	691
043	882
044	352
047	042
054	311
058	360
066	711
075	042
079	030
084	812
085	820
086	020
087	822
088	830
095	831
096	642
097	831
113,114,115,116, 117,118,119,123, 124,125,126,127, 128,129,133,134, 135,136,137,138, 139,143,144,145, 146,147,148,149, 153,154	850
155	862
156	842
157	842
163	842
164	852
165	872

Occupation Code	Imputed Industry Code
174	871
176	880
177	880
178	841
179	910
187	800
189	791
193	800
195	171
198	440
199	802
204	820
205	831
206	831
207	831
226	421
227	931
228	440
234	841
253	711
254	712
255	710
256	721
263	612
265	631
277	671
278	171
284	742
317	762
318	421
325	171
329	852
348	441
349	442
355	412
366	460
375	711
383	700
403	761
413	910
414	910
417	910
418	910
423	910
424	910
444	641
445	820
446	831

Occupation Code	Imputed Industry Code
447	831
449	762
455	722
457	780
458	772
459	802
464	800
465	421
466	762
467	871
484	010
486	021
488	010
495	030
496	230
497	031
498	031
505	751
506	751
508	421
514	751
517	530
527	441
529	441
534	060
535	760
536	760
543	312
553	060
554	060
556	060
557	060
558	060
563	060
564	060
565, 566	060
567	060
569	060
573	060
575	060
576	060
577	460
579	460
579	060
583	060
584	060
585	060
587	060

Occupation Code	Imputed Industry Code
588	060
594	060
595	060
597	060
598	060
599	060
614	042
615	041
658	242
666	790
667	151
668	760
669	782
673	151
677	372
678	840
679	172
683	342
688	111
694	471
695	460
726	241
729	241
733	241
734	171
735	172
736	171
738	142
739	132
743	151
744	151
745	221
747	771
748	771
763	111
766	270
773	800
774	742
793	742
808	401
809	402
813	750
823	400
824	400
825	400
826	400
828	420
829	420

Occupation Code	Imputed Industry Code
833	420
834	432
844	060
845	420
853	060
855	060
865	060
866	882
867	041
869	060
876	420
885	621

If the occupation codes are not reported for the following industry codes, the occupation codes may be imputed as indicated.

Industry Code	Imputed Occupation Code
030	495
230	496
401	808
402	809
410	804
772	458
780	457
790	666

Most of the entries on the list are for situations where a missing industry code can be imputed based on the occupation code. There are only a few situations where a missing occupation code can be imputed based on the industry code. For the sake of simplicity, the remaining discussion on imputing will be in terms of having a known occupation and imputing the industry, although it should be understood that the opposite can also occur.

Since the Census imputation list was developed for use with the 1980 U.S. Census, the suggested imputations may not always be appropriate for I/O data gathered from state death certificates. We have developed a method at NIOSH for adapting the Census list for use with death certificate data. In order to impute missing industry codes based on the corresponding occupation code, we developed the following procedure: (1) using the death certificates with non-missing I/O data, compute the percent distribution of industry codes within each occupation code on the Census list; (2) if at least 80% of the certificates for a particular occupation have the same industry code as the one recommended by the Census Bureau, then assign that industry code to those certificates which had the same occupation but a missing

or retired industry code; (3) if fewer than 80% had the recommended industry code, then let the missing or retired industry codes remain missing for that occupation. Two examples are given below:

Example 1 - The Census list recommends assigning an industry code of 781 (funeral service and crematories) when the occupation code is 018 (funeral director) and the industry is unknown. In a dataset containing death certificates from 16 states, among all funeral directors with a known industry, 99% had a code of 781. One funeral director had a missing industry code, so we imputed it to 781.

Example 2 - The Census list recommends assigning an industry code of 421 (air transportation) when the occupation code is 318 (transportation ticket and reservation agents) and the industry is unknown. In the 16 state dataset, among all ticket agents with a known industry, only 17% had an industry code of 421, while 63% had industry code of 400 (Railroads). Therefore we let industry remain missing for the 2 ticket agents who had a missing industry code.

Appendix F - Detailed Cause of Death Categories

	Cause of Death	ICD codes (9th revision)
1	Infectious and parasitic diseases	001 -139
2	Tuberculosis	010 -018 ,137
3	Pulmonary tuberculosis (SHEO)[1]	011
4	Tuberculous fibrosis of lung	011.4
5	Tularemia (SHEO)[1]	021
6	Brucellosis (SHEO)[1]	023
7	Cutaneous disease due to other mycobacteria	031.1
8	Tetanus (SHEO)[1]	037
9	Viral hepatitis a (SHEO)[1]	070.0,070.1
10	Viral hepatitis b (SHEO)[1]	070.2,070.3
11	Non-a,non-b viral hepatitis (SHEO)[1]	070.4-070.9
12	Rocky mountain spotted fever	082.0
13	Sporotrichosis	117.1
14	Sarcoidosis	135
15	Malignant neoplasms (Mn)	140 -208
16	Mn lip, oral cavity and pharynx	140 -149
17	Mn lip	140
18	Mn nasopharynx	147
19	Mn digestive organs and peritoneum	150 -159
20	Mn esophagus	150
21	Mn stomach	151
22	Mn small intestine, including duodenum	152
23	Mn colon, rectum, rectosigmoid junction and anus	153 -154 ,159.0
24	Mn colon	153
25	Mn rectum, rectosigmoid junction and anus	154
26	Mn liver and intrahepatic bile ducts	155
27	Hemangiosarcoma of liver (SHEO)[1]	155 ,171.5,171.9
28	Mn gallbladder and extrahepatic bile ducts	156
29	Mn pancreas	157
30	Mn peritoneum and pleura (SHEO)[1]	158 ,163
31	Mn retroperitoneum	158.0
32	Mn peritoneum	158.8,158.9
33	Mn respiratory and intrathoracic organs	160 -165
34	Mn nasal cavities, middle ear and accessory sinuses	160
35	Mn nasal cavities (SHEO)[1]	160.0,160.3-160.9

	Cause of Death	ICD codes (9th revision
36	Mn larynx (SHEO)[1]	161
37	Mn trachea, bronchus and lung (SHEO)[1]	162
38	Mn pleura and peritoneum (SHEO)[1]	158.8,158.9,163
39	Mn pleura	163
40	Mn thymus, heart, and mediastinum	164
41	Mn bone and articular cartilage (SHEO)[1]	170
42	Mn connective and other soft tissue	171
43	Malignant melanoma of skin	172
44	Other malignant neoplasm of skin	173
45	Mn breast	174,175
46	Mn female genital organs	179-184
47	Mn cervix uteri	180
48	Mn other parts of uterus	179,181 -182
49	Mn ovary and other uterine adnexa	183
50	Mn other and unspecified female genital organs	184
51	Mn prostate	185
52	Mn testis	186
53	Mn penis and other male genital organs	187
54	Mn scrotum (SHEO)[1]	187.7,187.9
55	Mn bladder (SHEO)[1]	188
56	Mn kidney and other and unspecified urinary organs (SHEO)[1]	189
57	Mn eye	190
58	Brain and nervous system, all neoplasms except secondary	191 -192 ,225, 237.5-237.9,239.6
59	Mn brain and nervous system	191 -192
60	Benign, uncertain & unspecified Neoplasms of brain & nervous sys	225,237.5-237.9,239.6
61	Mn thyroid gland	193
62	Mn other endocrine glands and related structures	194
63	Mn secondary, ill-defined and unspecified sites	195 -199
64	Mn lymphatic and hematopoietic tissue	200 -208
65	Non-hodgkin's lymphomas	200,202.0-202.2,202.8 202.9
66	Reticuloendothelioses	202.3-202.5
67	Hodgkin's disease	201
68	Multiple myeloma and immunoproliferative neoplasms	203
69	Leukemia	204 -208
70	Lymphoid leukemia (SHEO)[1]	204
71	Acute lymphoid leukemia	204.0
72	Chronic lymphoid leukemia	204.1
73	Myeloid leukemia (SHEO)[1]	205
74	Acute myeloid leukemia	205.0
75	Chronic myeloid leukemia	205.1
76	Monocytic leukemia	206

	Cause of Death	ICD codes (9th revision)
77	Erythroleukemia (SHEO)[1]	207
78	Erythremia and erythroleukemia	207.0,207.1
79	Other neoplasms	210 -239
80	Other neoplasms, except brain and nervous system	210 -224 ,226 -237.4, 238 -239.5,239.7-239.9
81	Polycythemia vera	238.4
82	Endocrine, nutritional, metabolic, and immunity disorders	240 -279
83	Endocrine disorders	240 -259
84	Disorders of thyroid gland	240 -246
85	Diabetes mellitus	250
86	Disorders of parathyroid gland	252
87	Disorders of the pituitary gland and its hypothalamic control	253
88	Disorders of adrenal glands	255
89	Nutritional deficiencies	260 -269
90	Other metabolic disorders and immunity disorders	270 -279
91	Diseases of blood and blood-forming organs	280 -289
92	Non-autoimmune and unspecified hemolytic anemias (SHEO)[1]	283.1,283.9
93	Aplastic anemia	284
94	Other and unspecified aplastic anemia (SHEO)[1]	284.8,284.9
95	Agranulocytosis	288.0
96	Agranulocytosis (SHEO)[1]	288.0,288.9
97	Methemoglobinemia (SHEO)[1]	289.7
98	Mental disorders	290 -319
99	Senile & presenile organic psychotic Cond, inc alzheimer's dis	290 ,331.0,331.1
100	Alcoholism	291 ,303 ,305.0,357.5, 425.5, 535.3,790.3, 571.0-571.3,860.0, 860.1
101	Mental disorders related to alcohol abuse	291,303,305.0
102	Mental disorders related to drug abuse	292 ,304 ,305.2-305.9
103	Diseases of the nervous system and sense organs	320 -389
104	Parkinson's disease (SHEO)[1]	332
105	Other cerebellar ataxia (SHEO)[1]	334.3
106	Anterior horn cell disease	335
107	Multiple sclerosis and other demyelinating diseases of the cns	340 -341
108	Epilepsy	345
109	Disorders of the peripheral nervous system	350 -357

	Cause of Death	ICD codes (9th revision
110	Mononeuritis of upper limb and mononeuritis multiplex	354.0,354.2,354.3
111	Myoneural disorders	358
112	Diseases of the circulatory system	390-459
113	Diseases of the heart	390-398,402,404 -429
114	Rheumatic fever and rheumatic heart disease	390-398
115	Hypertensive disease	401-405
116	Ischemic heart disease	410-414
117	Acute myocardial infarction	410
118	Other ischemic heart disease	411-414
119	Other forms of heart disease	415-429
120	Chronic pulmonary heart disease	416
121	Cerebrovascular disease	430-438
122	Diseases of arteries, arterioles, and capillaries	440-448
123	Raynaud's syndrome	443.0
124	Polyarteritis nodosa and allied conditions	446
125	Diseases of veins and lymphatics	451-457
126	Diseases of the respiratory system	460-519
127	Acute resp infections and other diseases of upper resp tract	460-478
128	Pneumonia and influenza	480-487
129	Other diseases of respiratory system	490-519
130	Chronic obstructive pulmonary disease and allied conditions	490-496
131	Extrinsic and unspecified asthma	493.0,493.9,507.8
132	Extrinsic allergic alveolitis (SHEO)[1]	495
133	Pneumoconioses	500-505
134	Coalworkers' pneumoconiosis (SHEO)[1]	500
135	Asbestosis (SHEO)[1]	501
136	Pneumoconiosis due to other silica or silicates (SHEO)[1]	502
137	Other and unspecified pneumoconiosis	503-505
138	Pneumoconiosis due to other inorganic dust (SHEO)[1]	503
139	Pleumopathy due to inhalation of other dust (SHEO)[1]	504
140	Respiratory conditions due to fumes, vapors, oils & essences (SHEO)[1]	506,507.1
141	Other lung dis due to external agents, exc inhalation of food	506,507.1-508
142	Diseases of the digestive system	520-579
143	Diseases of esophagus	530
144	Diseases of stomach and duodenum	531-537
145	Peptic ulcer	531-534

	Cause of Death	ICD codes (9th revision)
146	Regional enteritis	555
147	Idiopathic proctocolitis	556
148	Diseases of liver	570-573
149	Acute and subacute necrosis of liver	570
150	Toxic hepatitis (SHEO)[1]	570,573.3
151	Chronic liver disease and cirrhosis	571,572.1-572.8
152	Other hepatitis (except chronic)	070,573.1-573.3
153	Disorders of gallbladder and biliary tract	574-576
154	Diseases of pancreas	577
155	Diseases of the genitourinary system	580-629
156	Diseases of urinary system	580-599
157	Diseases of kidney	580-593
158	Acute or chronic renal failure (SHEO)[1]	584-586
159	Diseases of male genital organs	600-608
160	Diseases of female genital organs and breast	610-629
161	Complications of pregnancy, childbirth and the puerperium	630-676
162	Diseases of the skin and subcutaneous tissue	680-709
163	Contact dermatitis and other eczema (SHEO)[1]	692
164	Diseases of musculoskeletal system and connective tissue	710-739
165	Diffuse diseases of connective tissue	710
166	Rheumatoid arthritis and other inflammatory polyarthropathies	714
167	Disorders of bone and cartilage, other and unspecified	733.9
168	Congenital anomalies	740-759
169	Certain conditions originating in the perinatal period	760-779
170	Symptoms, signs and ill-defined conditions	780-799
171	External causes of injury and poisoning	800-999
172	Transport accidents	800-848,929.0-929.1
173	Railway accidents	800-807
174	Motor vehicle accidents	810-825,929.0
175	Motor vehicle nontraffic accidents	820-825
176	Water transport accidents	830-838
177	Air and space transport accidents	840-845
178	Powered vehicle accidents within buildings and premises	846
179	Accidental poisonings	850-869 ,929.2
180	Accidental poisonings by drugs, medicaments and biologicals	850-858

	Cause of Death	ICD codes (9th revision
181	Accidental poisonings by ethyl alcohol, not elsewhere classified	860.0,860.1
182	Accidental poisonings by other solid and liquid substances	860.2-866
183	Accidental poisonings by agric. Or horti. Chemical preparations	863
184	Accidental poisonings by other specified substances	866.0-866.8
185	Accidental poisonings by gases and vapors	867-869
186	Accidental falls	880-888 ,929.3
187	Fall on or from stairs or steps	880
188	Falls on or from ladders or scaffolds	881
189	Fall into hole or other opening in surface	883
190	Other fall from one level to another	884
191	Accidents caused by fire and flames, other than private dwelling	891-899
192	Accidents due to natural and environmental factors	900-909 ,929.5
193	Excessive heat	900
194	Accidents caused by submersion, suffocation and foreign bodies	910-915
195	Accidental drowning and submersion	910
196	Inhalation and ingestion of nonfood object	912
197	Accidental mechanical suffocation	913
198	Foreign body entering eye or other orifice	914-915
199	Certain accidents mainly of industrial type	846,916-921,923-927
200	Struck by falling object	916
201	Striking against or struck by objects or persons	917
202	Caught accidentally in or between objects	918
203	Accidents caused by machinery	919
204	Accidents caused by cutting and piercing instruments or objects	920
205	Accident caused by firearm missile	922
206	Accident caused by explosives	923
207	Accident caused by electric current	925
208	Accident caused by overexertion and strenuous movement	927
209	Suicide and selfinflicted injury	950 -959

	Cause of Death	ICD codes (9th revision)
210	Homicide and injury purposely inflicted by other persons	960 -969
211	Injury undetermined whether accidentally or purposely inflicted	980 -989

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[1] Titles and codes for SHE(O) categories are based on Rutstein's SHE(O) list with some modifications (see reference 78). Titles may not always accurately reflect ICD classifications.

Appendix G - Broad Groupings for Cause of Death

Cause of Death	ICD Code (9th Revision)
1. Tuberculosis, including late effects	010-018,137
2. Septicemia	038
3. Malignant neoplasms, including neoplasms of lymphatic and hematopoietic tissues	140-208
4. Malignant neoplasms of lip, oral cavity, and pharynx	140-149
5. Malignant neoplasm of esophagus	150
6. Malignant neoplasm of stomach	151
7. Malignant neoplasm of colon	153
8. Malignant neoplasms of rectum, rectosigmoid junction, and anus	154
9. Malignant neoplasms of liver and intrahepatic bile ducts	155
10. Malignant neoplasms of gallbladder and extrahepatic bile ducts	156
11. Malignant neoplasm of pancreas	157
12. Malignant neoplasm of larynx	161
13. Malignant neoplasms of trachea, bronchus, and lung	162
14. Malignant neoplasm of pleura	163
15. Malignant neoplasms of bone and articular cartilage	170
16. Malignant neoplasms of connective and other soft tissue	171
17. Malignant melanoma of skin	172
18. Malignant neoplasm of female breast	174
19. Malignant neoplasm of cervix uteri	180
20. Malignant neoplasm of body of uterus	182
21. Malignant neoplasms of ovary and other uterine adnexa	183
22. Malignant neoplasm of prostate	185
23. Malignant neoplasm of testis	186
24. Malignant neoplasm of bladder	188
25. Malignant neoplasms of kidney and other and unspecified urinary organs	189
26. Malignant neoplasms of brain and other and unspecified parts of nervous system	191-192
27. Hodgkin's disease	201
28. Malignant lymphoma other than Hodgkin's disease	200,202
29. Multiple myeloma and immunoproliferative neoplasms	203

Cause of Death	ICD Code (9th Revision)
30. Leukemia	204-208
31. All other malignant neoplasms, including neoplasms of lymphatic and hematopoietic tissues	152,158-160,164-165, 173,175,179,181,184, 187,190,193-199
32. Diabetes mellitus	250
33. Aplastic anemia	284
34. Diseases of the heart	390-398,402,404-429
35. Hypertensive heart disease	402
36. Hypertensive heart and renal disease	404
37. Ischemic heart disease	410-414
38. Acute myocardial infarction	410
39. All other ischemic heart disease	411-414
40. All other diseases of heart	390-398,415-429
41. Hypertension with or without renal disease	401,403
42. Cerebrovascular diseases	430-438
43. Atherosclerosis	440
44. Pneumonia and influenza	480-487
45. Chronic obstructive pulmonary diseases and allied conditions	490-496
46. Pneumoconioses and pneumopathy due to inhalation of other dust	500-505
47. Ulcer of stomach and duodenum	531-533
48. Chronic liver disease and cirrhosis	571
49. Nephritis, nephrotic syndrome, and nephrosis	580-589
50. Accidents and adverse effects	E800-E949
51. Motor vehicle accidents	E810-E825
52. Accidents mainly of industrial type	E846,E881-E882, E916-E919,E921, E923-E926
53. Other accidents and adverse effects	E800-E807,E826-E845 E847-E880,E883-E915 E920,E922,E927-E949
54. Suicide	E950-E959
55. Homicide and legal intervention	E960-E978

Appendix H - Detailed Industry and Occupation Categories

DETAILED INDUSTRY CATEGORIES

	Title	1980 Census Codes
1	Agriculture, forestry, & fisheries	010-031
2	Agriculture	010-020
3	Agricultural production, crops	010
4	Agricultural production, livestock	011
5	Agricultural services, exc horticultural	020
6	Horticultural services	021
7	Forestry	030
8	Fishing, hunting, & trapping	031
9	Mining	040-051
10	Metal mining	040
11	Coal mining	041
12	Crude petroleum & natural gas extraction	042
13	Nonmetallic mining & quarrying, exc fuel	050
14	Construction	060
15	Manufacturing (mfg)	100-392
16	Nondurable goods (mfg)	100-222
17	Food & kindred products (mfg)	100-122
18	Meat products (mfg)	100
19	Dairy products (mfg)	101
20	Canned & preserved fruits & vegetables (mfg)	102
21	Grain mill products (mfg)	110
22	Bakery products (mfg)	111
23	Sugar & confectionery products (mfg)	112
24	Beverage industries (mfg)	120
25	Miscellaneous food preparations & kindred products (mfg)	121
26	Not specified food industries (mfg)	122
27	Tobacco manufactures	130
28	Textile mill products (mfg)	132-150
29	Knitting mills (mfg)	132
30	Dyeing & finishing textiles, exc wool & knit goods (mfg)	140

	Title	1980 Census Codes
31	Floor coverings, exc hard surface (mfg)	141
32	Yarn, thread, & fabric mills (mfg)	142
33	Miscellaneous textile mill products (mfg)	150
34	Apparel & other finished textile products (mfg)	151-152
35	Apparel & accessories, exc knit (mfg)	151
36	Miscellaneous fabricated textile products (mfg)	152
37	Paper & allied products (mfg)	160-162
38	Pulp, paper, & paperboard mills (mfg)	160
39	Miscellaneous paper & pulp products (mfg)	161
40	Paperboard containers & boxes (mfg)	162
41	Printing, publishing & allied industries	171-172
42	Newspaper publishing & printing	171
43	Printing, publishing & allied industries, exc newspapers	172
44	Chemicals & allied products (mfg)	180-192
45	Plastics, synthetics, & resins (mfg)	180
46	Drugs (mfg)	181
47	Soaps & cosmetics (mfg)	182
48	Paints, varnishes, & related products (mfg)	190
49	Agricultural chemicals (mfg)	191
50	Industrial & miscellaneous chemicals (mfg)	192
51	Petroleum & coal products (mfg)	200-201
52	Petroleum refining	200
53	Miscellaneous petroleum & coal products (mfg)	201
54	Rubber & miscellaneous plastics products (mfg)	210-212
55	Tires & inner tubes (mfg)	210
56	Other rubber products, & plastics footwear & belting (mfg)	211
57	Miscellaneous plastics products (mfg)	212
58	Leather & leather products (mfg)	220-222
59	Leather tanning & finishing (mfg)	220
60	Leather products (mfg)	221-222
61	Footwear, exc rubber & plastic (mfg)	221
62	Leather products, exc footwear (mfg)	222
63	Durable goods (mfg)	230-390
64	Lumber & wood products, exc furniture (mfg)	230-241
65	Logging	230
66	Sawmills, planing mills, & millwork	231

	Title	1980 Census Codes
67	Wood buildings & mobile homes (mfg)	232
68	Miscellaneous wood products (mfg)	241
69	Furniture & fixtures (mfg)	242
70	Stone, clay, glass, & concrete products (mfg)	250-262
71	Glass & glass products (mfg)	250
72	Cement, concrete, gypsum, & plaster products (mfg)	251
73	Structural clay products (mfg)	252
74	Pottery & related products (mfg)	261
75	Miscellaneous nonmetallic mineral & stone products (mfg)	262
76	Metal industries (mfg)	270-301
77	Primary metal industries (mfg)	270-280
78	Primary iron and steel industries (mfg)	270,271
79	Blast furnaces, steelworks, rolling & finishing mills (mfg)	270
80	Iron & steel foundries (mfg)	271
81	Primary aluminum industries (mfg)	272
82	Other primary metal industries (mfg)	280
83	Fabricated metal products, exc machinery & trans eqpt (mfg)	281-300
84	Cutlery, hand tools, & other hardware (mfg)	281
85	Fabricated structural metal products (mfg)	282
86	Screw machine products (mfg)	290
87	Metal forgings & stampings (mfg)	291
88	Ordnance (mfg)	292
89	Miscellaneous fabricated metal products (mfg)	300
90	Not specified metal industries (mfg)	301
91	Machinery, exc electrical (mfg)	310-332
92	Engines & turbines (mfg)	310
93	Farm machinery & equipment (mfg)	311
94	Construction & material handling machines (mfg)	312
95	Metalworking machinery (mfg)	320
96	Office & accounting machines (mfg)	321
97	Electronic computing equipment (mfg)	322
98	Machinery, exc electrical, nec (mfg)	331
99	Not specified machinery (mfg)	332
100	Electrical machinery, equipment, & supplies (mfg)	340-350
101	Household appliances (mfg)	340
102	Radio, tv, & communication equipment (mfg)	341

	Title	1980 Census Codes
103	Electrical machinery, equipment, & supplies, nec (mfg)	342
104	Not specif. Electrical machinery, equipment & supplies (mfg)	350
105	Transportation equipment (mfg)	351-370
106	Motor vehicles & motor vehicle equipment (mfg)	351
107	Aircraft & parts (mfg)	352
108	Ship & boat building & repairing (mfg)	360
109	Railroad locomotives & equipment (mfg)	361
110	Guided missiles, space vehicles, & parts (mfg)	362
111	Cycles & miscellaneous transportation equipment (mfg)	370
112	Professional & photographic equipment, & watches (mfg)	371-382
113	Scientific & controlling instruments (mfg)	371
114	Optical & health services supplies (mfg)	372
115	Photographic equipment & supplies (mfg)	380
116	Watches, clocks, & clockwork operated devices (mfg)	381
117	Not specified professional equipment (mfg)	382
118	Toys, amusement, & sporting goods (mfg)	390
119	Miscellaneous manufacturing industries	391
120	Not specified manufacturing industries	392
121	Transportation, communications, & other public utilities	400-472
122	Transportation	400-432
123	Railroads	400
124	Bus service & urban transit	401
125	Taxicab service	402
126	Trucking service	410
127	Warehousing & storage	411
128	U.S. Postal Service	412
129	Water transportation	420
130	Air transportation	421
131	Pipe lines, exc natural gas	422
132	Services incidental to transportation	432
133	Communications	440-442
134	Radio & television broadcasting	440
135	Telephone (wire & radio)	441
136	Telegraph & miscellaneous commmunication services	442

	Title	1980 Census Codes
137	Utilities & sanitary services	460-472
138	Electric & gas utilities	460-462
139	Electric light & power	460
140	Gas & steam supply systems	461
141	Electric & gas, & other combinations	462
142	Water supply & irrigation	470
143	Sanitary services	471
144	Not specified utilities	472
145	Wholesale trade	500-571
146	Durable goods (whls)	500-532
147	Motor vehicles & equipment (whls)	500
148	Furniture & home furnishings (whls)	501
149	Lumber & construction materials (whls)	502
150	Sporting goods, toys, & hobby goods (whls)	510
151	Metals & minerals, exc petroleum (whls)	511
152	Electrical goods (whls)	512
153	Hardware, plumbing & heating supplies (whls)	521
154	Not specified electrical & hardware products (whls)	522
155	Machinery, equipment, & supplies (whls)	530
156	Scrap & waste materials (whls)	531
157	Miscellaneous wholesale, durable goods (whls)	532
158	Nondurable goods (whls)	540-562
159	Paper & paper products (whls)	540
160	Drugs, chemicals, & allied products (whls)	541
161	Apparel, fabrics, & notions (whls)	542
162	Groceries & related products (whls)	550
163	Farm-product raw materials (whls)	551
164	Petroleum products (whls)	552
165	Alcoholic beverages (whls)	560
166	Farm supplies (whls)	561
167	Miscellaneous wholesale, nondurable goods	562
168	Not specified wholesale trade	571
169	Retail trade	580-691
170	Lumber & building material retailing	580
171	Hardware stores (ret)	581
172	Retail nurseries & garden stores (ret)	582
173	Mobile home dealers (ret)	590
174	General merchandise stores (ret)	591-600
175	Department stores (ret)	591
176	Variety stores (ret)	592

	Title	1980 Census Codes
177	Miscellaneous general merchandise stores (ret)	600
178	Food stores (ret)	601-611
179	Grocery stores (ret)	601
180	Dairy products stores (ret)	602
181	Retail bakeries	610
182	Food stores, nec (ret)	611
183	Motor vehicle dealers (ret)	612
184	Auto & home supply stores (ret)	620
185	Gasoline service stations (ret)	621
186	Miscellaneous vehicle dealers (ret)	622
187	Apparel & accessory stores, exc shoe (ret)	630
188	Shoe stores (ret)	631
189	Furniture & home furnishings stores (ret)	632
190	Household appliances, tv, & radio stores (ret)	640
191	Eating & drinking places (ret)	641
192	Drug stores (ret)	642
193	Liquor stores (ret)	650
194	Sporting goods, bicycles, & hobby stores (ret)	651
195	Book & stationery stores (ret)	652
196	Jewelry stores (ret)	660
197	Sewing, needlework, & piece goods stores (ret)	661
198	Mail order houses (ret)	662
199	Vending machine operators (ret)	670
200	Direct selling establishments (ret)	671
201	Fuel & ice dealers (ret)	672
202	Retail florists	681
203	Miscellaneous retail stores	682
204	Not specified retail trade	691
205	Finance, insurance, & real estate	700-712
206	Banking and other credit agencies	700-702
207	Banking	700
208	Savings & loan associations	701
209	Credit agencies, nec	702
210	Security, commodity brokerage, & investment companies	710
211	Insurance	711
212	Real estate, including real estate-insurance-law offices	712
213	Business & repair services	721-760
214	Advertising	721
215	Services to dwellings & other buildings	722

	Title	1980 Census Codes
216	Commercial research, development, & testing labs	730
217	Personnel supply services	731
218	Business management & consulting services	732
219	Computer & data processing services	740
220	Detective & protective services	741
221	Business services, nec	742
222	Automotive services, exc repair	750
223	Automotive repair shops	751
224	Electrical repair shops	752
225	Miscellaneous repair shops	760
226	Personal services	761-791
227	Private households	761
228	Hotels & motels	762
229	Lodging places, exc hotels & motels	770
230	Laundry, cleaning, & garment services	771
231	Beauty and barber shops	772,780
232	Beauty shops	772
233	Barber shops	780
234	Funeral service & crematories	781
235	Shoe repair shops	782
236	Dressmaking shops	790
237	Miscellaneous personal services	791
238	Entertainment & recreation services	800-802
239	Theaters & motion pictures	800
240	Bowling alleys, billiard & pool parlors	801
241	Miscellaneous entertainment & recreation services	802
242	Professional & related services	812-892
243	Health services	812-840
244	Offices of physicians	812
245	Offices of dentists	820
246	Offices of chiropractors	821
247	Offices of optometrists	822
248	Offices of health practitioners, nec	830
249	Hospitals	831
250	Nursing & personal care facilities	832
251	Health services, nec	840
252	Legal services	841
253	Educational services	842-860
254	Elementary & secondary schools	842
255	Colleges & universities	850
256	Business, trade, & vocational schools	851
257	Libraries	852
258	Educational services, nec	860
259	Social services	861-871

	Title	1980 Census Codes
260	Job training & vocational rehabilitation services	861
261	Child day care services	862
262	Residential care facilities, without nursing	870
263	Social services, nec	871
264	Museums, art galleries, & zoos	872
265	Religious organizations	880
266	Membership organizations	881
267	Engineering, architectural, & surveying services	882
268	Accounting, auditing, & bookkeeping services	890
269	Noncommerical educational & scientific research	891
270	Miscellaneous professional & related services	892
271	Public administration	900-932
272	Executive & legislative offices	900
273	General government, nec	901
274	Justice, public order, & safety	910
275	Public finance, taxation, & monetary policy	921
276	Administration of human resources programs	922
277	Administration of environmental quality & housing programs	930
278	Administration of economic programs	931
279	National security & international affairs	932
280	Armed forces	942
281	Retired	951
282	None, never worked, unpaid workers	961
283	Industry not reported or insufficient information (grouped)	981,990
284	Unresolved referral	981
285	Industry not reported	990

DETAILED OCCUPATION CATEGORIES

	Title	1980 Census Codes
1	Executive, administrative, & managerial occupations	003-037
2	Managers and administrators	003-017,019
3	Funeral directors	018
4	Management related occupations	023-037
5	Financial officers	023-025
6	Purchasing agents and buyers	028-033
7	Professional specialty occupations	043-199
8	Architects	043
9	Engineers	044-062
10	Aerospace engineers	044
11	Metallurgical & materials engineers	045
12	Mining engineers	046
13	Petroleum engineers	047
14	Chemical engineers	048
15	Nuclear engineers	049
16	Civil engineers	053
17	Agricultural engineers	054
18	Electrical & electronic engineers	055
19	Industrial engineers	056
20	Mechanical engineers	057
21	Marine engineers & naval architects	058
22	Engineers, nec	059
23	Surveyors & mapping scientists	063
24	Mathematical & computer scientists	064-068
25	Natural scientists	069-083
26	Physicists & astronomers	069
27	Chemists, exc biochemists	073
28	Atmospheric & space scientists	074
29	Geologists & geodesists	075
30	Physical scientists, nec	076
31	Agricultural & food scientists	077
32	Biological, life, and medical scientists	078,083
33	Forestry & conservation scientists	079
34	Health diagnosing occupations	084-089
35	Physicians	084
36	Dentists	085
37	Veterinarians	086
38	Optometrists	087
39	Podiatrists	088
40	Health diagnosing practitioners, nec	089
41	Health assessment & treating occupations	095-106

	Title	1980 Census Codes
42	Nurses	095,207
43	Registered nurses	095
44	Pharmacists	096
45	Dietitians	097
46	Therapists	098-105
47	Physicians' assistants	106
48	Teachers	113-159
49	Teachers, postsecondary	113-154
50	Science teachers, postsecondary	113-117,133,134,136
51	Teachers, exc postsecondary	155-159
52	Counselors, educational & vocational	163
53	Librarians, archivists, & curators	164,165
54	Social scientists & urban planners	166-173
55	Social, recreation, & religious workers	174-177
56	Social workers	174
57	Recreation workers	175
58	Clergy	176
59	Religious workers, nec	177
60	Lawyers & judges	178,179
61	Writers, artists, entertainers, & athletes	183-199
62	Writers	183,184,195
63	Designers	185
64	Entertainers	186,187,193,194,198
65	Painters, sculptors, craft-artists, & artist printmakers	188
66	Photographers	189
67	Public relations specialists	197
68	Athletes	199
69	Technical, sales, & administrative support occupations	203-389
70	Technicians & related support occupations	203-235
71	Health technologists & technicians	203-208
72	Clinical laboratory technologists & technicians	203
73	Dental hygienists	204
74	Health record technologists & technicians	205
75	Radiologic technicians	206
76	Licensed practical nurses	207
77	Health technologists & technicians, nec	208
78	Engineering & related technologists & technicians	213-218
79	Electrical & electronic technicians	213
80	Industrial engineering technicians	214
81	Mechanical engineering technicians	215

	Title	1980 Census Codes
82	Engineering technicians, nec	216
83	Drafting occupations	217
84	Surveyors	063,218
85	Surveying & mapping technicians	218
86	Science technicians	223-225
87	Biological technicians	223
88	Chemical technicians	224
89	Science technicians, nec	225
90	Technicians, exc health, engineering, & science	226-235
91	Airplane pilots & navigators	226
92	Air traffic controllers	227
93	Broadcast equipment operators	228
94	Computer programmers	229
95	Tool programmers, numerical control	233
96	Legal assistants	234
97	Technicians, nec	235
98	Sales occupations	243-285
99	Supervisors & proprietors, sales occupations	243
100	Sales representatives, finance and business services	253-257
101	Sales representatives, commodities exc retail	258,259
102	Sales workers, retail and personal services	263-278
103	Sales related occupations	283-285
104	Administrative support occupations, inc clerical	303-389
105	Supervisors, administrative support occupations	303-307
106	Computer equipment operators	304,308,309
107	Secretaries, stenographers, & typists	313-315
108	Information clerks	316-323
109	Records processing occupations, exc financial	325-336
110	Financial records processing occupations	305,337-344
111	Duplicating, mail & other office machine operators	345-347
112	Communications equipment operators	306,348-353
113	Mail & message distributing occupations	354-357
114	Material recording, scheduling, & distributing clerks, nec	359-374
115	Adjusters & investigators	375-378
116	Miscellaneous administrative support occupations	379-389
117	Bank tellers	383

	Title	1980 Census Codes
118	Service occupations	403-469
119	Private household occupations	403-407
120	Launderers & ironers	403
121	Cooks, private household	404
122	Housekeepers & butlers	405
123	Child care workers, private household	406
124	Private household cleaners & servants	407
125	Protective service occupations	006,413-427
126	Supervisors, protective service occupations	413-415
127	Supervisors, firefighting & fire prevention occupations	413
128	Supervisors, police & detectives	414
129	Supervisors, guards	415
130	Firefighting & fire prevention occupations	413,416,417
131	Fire inspection & fire prevention occupations	416
132	Firefighting occupations	413,417
133	Firefighting occupations	417
134	Police & detectives	414,418-424
135	Police & detectives, public service	414,418
136	Police & detectives, public service	418
137	Sheriffs, bailiffs, & other law enforcement officers	423
138	Correctional institution officers	424
139	Guards	415,425-42
140	Crossing guards	425
141	Guards & police, exc public service	426
142	Protective service occupations, nec	427
143	Service occupations, exc protective & private household	433-469
144	Food preparation & service occupations	433-444
145	Supervisors, food preparation & service occupations	433
146	Bartenders	434
147	Waiters & waitresses	435
148	Cooks	404,433,436,437
149	Cooks, exc short order	436
150	Short-order cooks	437
151	Food counter, fountain & related occupations	438
152	Kitchen workers, food preparation	439
153	Waiters' & waitresses' assistants	443
154	Miscellaneous food preparation occupations	444
155	Health service occupations	445-447
156	Dental assistants	445

	Title	1980 Census Codes
157	Health aides, exc nursing	446
158	Nursing aides, orderlies, & attendants	447
159	Cleaning & building service occupations, exc priv household	448-455
160	Cleaning service workers	448,449,453
161	Supervisors, cleaning & building service workers	448
162	Maids & housemen	449
163	Janitors & cleaners	453
164	Elevator operators	454
165	Pest control occupations	455
166	Personal service occupations	456-469
167	Supervisors, personal service occupations	456
168	Barbers, hairdressers, & cosmetologists	457,458
169	Barbers	457
170	Hairdressers & cosmetologists	458
171	Attendants, amusement & recreation facilities	459
172	Guides	463
173	Ushers	464
174	Public transportation attendants	465
175	Baggage porters & bellhops	466
176	Welfare service aides	467
177	Child care workers	406,468
178	Child care workers, exc private household	468
179	Personal service occupations, nec	469
180	Farming, forestry, & fishing occupations	473-499
181	Farming & related occupations	473-479,484-489
182	Farmers	473-479,484
183	Farm operators & managers	473-476
184	Farm operators	473,474
185	Farmers, exc horticultural	473
186	Farmers & managers, horticultural specialty farms	474,476
187	Horticultural specialty farmers	474
188	Managers, farms	475,476
189	Managers, farms, exc horticultural	475
190	Managers, horticultural specialty farms	476
191	Other agricultural & related occupations	477-489
192	Farm occupations, exc managerial	477-484
193	Supervisors, farm workers	477
194	Farm workers	479
195	Marine life cultivation workers	483

	Title	1980 Census Codes
196	Nursery workers	484
197	Related agricultural occupations	485-489
198	Supervisors, related agricultural occupations	485
199	Groundskeepers & gardeners, exc farm	486
200	Animal caretakers, exc farm	487
201	Graders, & sorters, agricultural products	488
202	Inspectors, agricultural products	489
203	Forestry & logging occupations	494-496
204	Supervisors, forestry & logging workers	494
205	Forestry workers, exc logging	495
206	Timber cutting & logging occupations	496
207	Fishers, hunters, & trappers	497-499
208	Fishers & fishing vessel officers	497,498
209	Captains & other officers, fishing vessels	497
210	Fishers	498
211	Hunters & trappers	499
212	Precision production, craft, & repair occupations	503-699
213	Mechanics & repairers	503-549
214	Supervisors, mechanics & repairers	503
215	Mechanics & repairers, exc supervisors	505-549
216	Vehicle & mobile equipment mechanics & repairers	505-517
217	Automobile mechanics	505-506
218	Bus, truck, & stationary engine mechanics	507
219	Aircraft mechanics	508,515
220	Small engine repairers	509
221	Automobile body & related repairers	514
222	Heavy equipment mechanics	516
223	Farm equipment mechanics	517
224	Industrial machinery repairers	518
225	Machinery maintenance occupations	519
226	Electrical & electronic equipment repairers	523-533
227	Electronic repairers, communications & industrial equipment	523
228	Data processing equipment repairers	525
229	Household appliance & power tool repairers	526
230	Telephone line installers & repairers	527
231	Telephone installers & repairers	529
232	Miscellaneous electrical & electronic equipment repairers	533
233	Heating, air conditioning, & refrigeration mechanics	534

	Title	1980 Census Codes
234	Miscellaneous mechanics & repairers	535-549
235	Camera, watch, & musical instrument repairers	535
236	Locksmiths & safe repairers	536
237	Office machine repairers	538
238	Mechanical controls & valve repairers	539
239	Elevator installers & repairers	543
240	Millwrights	544
241	Specified mechanics & repairers, nec	547
242	Not specified mechanics & repairers	549
243	Construction trades	553-599
244	Supervisors, construction occupations	553-558
245	Supervisors, brickmasons, stonemasons, & tile setters	553
246	Supervisors, carpenters & related workers	554
247	Supervisors, electricians & power transmission installers	555
248	Supervisors, painters, paperhangers, & plasterers	556
249	Supervisors, plumbers, pipefitters, & steamfitters	557
250	Supervisors, nec	558
251	Construction trades, exc supervisors	563-599
252	Brickmasons & stonemasons	553,563,564
253	Tile setters, hard & soft	565
254	Carpet installers	566
255	Carpenters	554,567,569
256	Drywall installers	573
257	Electricians & power transmission installers	555,575-577
258	Electricians	555,575,576
259	Electrical power installers & repairers	577
260	Painters, paperhangers, & plasterers	556,579-584
261	Painters, construction & maintenance	556,579
262	Paperhangers	583
263	Plasterers	584
264	Plumbers, pipefitters, & steamfitters	557,585,587
265	Concrete & terrazzo finishers	588
266	Glaziers	589
267	Insulation workers	593
268	Paving, surfacing, & tamping equipment operators	594
269	Roofers	595
270	Sheetmetal duct installers	596
271	Structural metal workers	597
272	Drillers, earth	598
273	Construction trades, nec	599

	Title	1980 Census Codes
274	Extractive occupations (grouped)	613-617,867
275	Supervisors, extractive occupations	613
276	Drillers, oil well	614
277	Explosives workers	615
278	Mining machine operators	616
279	Mining occupations, nec	617
280	Precision production occupations	633-699
281	Supervisors, production occupations	633
282	Precision metal working occupations	634-655
283	Tool & die makers	634,635
284	Precision assemblers, metal	636
285	Machinists	637,639
286	Boilermakers	643
287	Precision grinders, fitters, & tool sharpeners	644
288	Pattern & model makers, metal	645
289	Lay-out workers	646
290	Precious stones & metals workers (jewelers)	647
291	Engravers, metal	649
292	Sheet metal workers (grouped)	596,653,654
293	Sheet metal workers	653,654
294	Miscellaneous precision metal workers	655
295	Precision woodworking occupations	656-659
296	Patternmakers & model makers, wood	656
297	Cabinet makers & bench carpenters	657
298	Furniture & wood finishers	658
299	Miscellaneous precision woodworkers	659
300	Precision textile, apparel, & furnishings machine workers	666-674
301	Precision textile & apparel machine workers	666,667,673,674
302	Dressmakers	666
303	Tailors	667
304	Upholsterers	668
305	Shoe repairers	669
306	Apparel and fabric patternmakers	673
307	Miscellaneous precision apparel and fabric workers	674
308	Precision workers, assorted materials	675-684
309	Hand molders & shapers, exc jewelers	675
310	Patternmakers, lay-out workers, & cutters	676
311	Optical goods workers	677
312	Dental laboratory & medical appliance technicians	678
313	Bookbinders	679

	Title	1980 Census Codes
314	Electrical & electronic equipment assemblers	683
315	Miscellaneous precision workers, nec	684
316	Precision food production occupations	686-688
317	Butchers & meat cutters	686
318	Bakers	687
319	Food batchmakers	688
320	Precision inspectors, testers, & related workers	689,693
321	Inspectors, testers, & graders	689
322	Adjusters & calibrators	693
323	Plant & system operators	694-699
324	Water & sewage treatment plant operators	694
325	Power plant operators	695
326	Stationary engineers	696
327	Miscellaneous plant & system operators	699
328	Operators, fabricators, & laborers	703-889
329	Machine operators, assemblers, & inspectors	703-799
330	Machine operators & tenders, exc precision	703-779
331	Metalworking & plastic working machine operators	703-715
332	Lathe & turning machine set-up operators	703
333	Lathe & turning machine operators	704
334	Milling & planing machine operators	705
335	Punching & stamping press machine operators	706
336	Rolling machine operators	707
337	Drilling & boring machine operators	708
338	Grinders, filers, polishers, buffers (grouped)	644,709,794
339	Grinding, abrading, buffing, & polishing machine operators	709
340	Forging machine operators	713
341	Numerical control machine operators	714
342	Misc metal, plastic, stone, & glassworking machine operators	715
343	Fabricating machine operators, nec	717
344	Metal & plastic processing machine operators	719-725
345	Molding & casting machine operators	719
346	Metal plating machine operators	723
347	Heat treating equipment operators	724
348	Miscellaneous metal & plastic processing machine operators	725

	Title	1980 Census Codes
349	Woodworking machine operators	726-733
350	Wood lathe, routing, & planing machine operators	726
351	Sawing machine operators	727
352	Shaping & joining machine operators	728
353	Nailing & tacking machine operators	729
354	Miscellaneous woodworking machine operators	733
355	Printing machine operators	734-737
356	Printing machine operators	734
357	Photoengravers & lithographers	735
358	Typesetters & compositors	736
359	Miscellaneous printing machine operators	737
360	Textile, apparel, & furnishings machine operators	738-749
361	Textile & apparel machine operators	738-744,749
362	Winding & twisting machine operators	738
363	Knitting, looping, taping, & weaving machine operators	739
364	Textile cutting machine operators	743
365	Textile sewing machine operators	744
366	Shoe machine operators	745
367	Pressing machine operators	747
368	Laundering & dry cleaning machine operators	748
369	Miscellaneous textile machine operators	749
370	Machine operators, assorted materials	753-779
371	Cementing & gluing machine operators	753
372	Packaging & filling machine operators	754
373	Extruding & forming machine operators	755
374	Mixing & blending machine operators	756
375	Separating, filtering, & clarifying machine operators	757
376	Compressing & compacting machine operators	758
377	Painting & paint spraying machine operators	759
378	Roasting & baking machine operators, food	763
379	Washing, cleaning, & pickling machine operators	764
380	Folding machine operators	765
381	Furnace, kiln, & oven operators, exc food	766
382	Crushing & grinding machine operators	768
383	Slicing & cutting machine operators	769
384	Motion picture projectionists	773

	Title	1980 Census Codes
385	Photographic process machine operators	774
386	Miscellaneous machine operators, nec	777
387	Machine operators, not specified	779
388	Fabricators, assemblers, and hand working occupations	783-795
389	Welders & cutters	783
390	Solderers & brazers	784
391	Assemblers	785
392	Hand cutting & trimming occupations	786
393	Hand molding, casting, & forming occupations	787
394	Hand painting, coating, & decorating occupations	789
395	Hand engraving & printing occupations	793
396	Hand grinding & polishing occupations	794
397	Miscellaneous hand working occupations	795
398	Production inspectors, testers, samplers, & weighers	796-799
399	Production inspectors, checkers & examiners	796
400	Production testers	797
401	Production samplers & weighers	798
402	Graders & sorters, exc agricultural	799
403	Transportation & material moving occupations	803-859
404	Motor vehicle operators	803-814
405	Supervisors, motor vehicle operators	803
406	Truck drivers	804,805
407	Truck drivers, heavy	804
408	Truck drivers, light	805
409	Driver-sales workers	806
410	Bus drivers	808
411	Taxi cab drivers & chauffeurs	809
412	Parking lot attendants	813
413	Motor transportation occupations, nec	814
414	Transportation occupations, exc motor vehicles	823-834
415	Rail transportation occupations	823-826
416	Railroad conductors & yardmasters	823
417	Locomotive operating occupations	824
418	Railroad brake, signal, & switch operators	825
419	Rail vehicle operators, nec	826
420	Water transportation occupations	828-834
421	Ship captains & mates (grouped)	497,828
422	Ship captains & mates, exc fishing boats	828
423	Sailors & deckhands	829

	Title	1980 Census Codes
424	Marine engineers	833
425	Bridge, lock, & lighthouse tenders	834
426	Material moving equipment operators	843-859
427	Supervisors, material moving equipment operators	843
428	Operating engineers	844
429	Longshore equipment operators	845
430	Hoist & winch operators	848
431	Crane & tower operators	849
432	Excavating, grading, & road machine operators (grouped)	594,844,853,855
433	Excavating & loading machine operators	853
434	Grader, dozer, & scraper operators	855
435	Industrial truck & tractor equipment operators	856
436	Miscellaneous material moving equipment operators	859
437	Handlers, equipment cleaners, helpers, & laborers	863-889
438	Supervisors, handlers, equipment cleaners, & laborers, nec	863
439	Helpers, mechanics & repairers	864
440	Helpers, construction & extractive occupations	865-867
441	Helpers, construction trades	865
442	Helpers, surveyor	866
443	Helpers, extractive occupations	867
444	Construction laborers	869
445	Production helpers	873
446	Freight, stock, & material movers, hand	875-883
447	Garbage collectors	875
448	Longshoremen & stevedores (grouped)	845,876
449	Stevedores	876
450	Stock handlers & baggers	877
451	Machine feeders & offbearers	878
452	Freight, stock, & material movers, hand, nec	883
453	Garage & service station related occupations	885
454	Vehicle washers & equipment cleaners	887
455	Hand packers & packagers	888
456	Laborers, exc construction	889
457	Armed forces	905
458	Retired	913
459	Housewives, homemakers	914
460	Students	915
461	Volunteers	916

	Title	1980 Census Codes
462	None, never worked, institutionalized	917
463	Occupation not reported or insufficient information	989,999
464	Health occupations (grouped)	015,084-106, 203-208,445-447
465	Chemists (grouped)	048,073,115,224
466	Postal occupations (grouped)	017,354,355
467	Woodworking occupations (grouped)	554,567,569, 656-659,726-733
468	Construction occupations (grouped)	553-599,865,869
469	Painters (grouped)	579,759,789
470	Textile and apparel workers (grouped)	666,667,673,674, 738-744,749
471	Glass workers (grouped)	589,677
472	Sailors (grouped)	497,498,828-833

Appendix I - Broad Groupings for Industry and Occupation

BROAD GROUPINGS FOR INDUSTRY

	Title	1980 Census Codes
1	Agriculture, Forestry, and Fisheries	010-031
2	Mining	040-050
3	Construction	060
4	Manufacturing	100-392
5	Nondurable Goods	100-222
6	Food and Kindred Products	100-130
7	Textile Mill and Finished Products	132-152
8	Paper and Allied Products	160-162
9	Printing, Publishing and Allied Products	171-172
10	Chemicals and Allied Products	180-192
11	Petroleum and Coal Products	200-201
12	Rubber, Plastics and Leather Products	210-222
13	Durable Goods	230-392
14	Lumber and Wood Products, and Furniture	230-242
15	Stone, Clay, Glass and Concrete products	250-262
16	Primary Metal Industries	270-280
17	Fabricated Metal Industries	281-301
18	Machinery, Except Electrical	310-332
19	Electrical Machinery, Equipment, and Supplies	340-350
20	Transportation Equipment	351-370
21	Miscellaneous Manufacturing Industries	371-392
22	Transportation, Communications, and Other Public Utilities	400-472
23	Transportation	400-432
24	Railroads	400
25	Trucking and Warehousing	410-411
26	Other Transportation	401-402, 412-432
27	Communications	440-442
28	Utilities and Sanitary Services	460-472
29	Wholesale Trade	500-571
30	Retail Trade	580-691
31	Food, Bakery, and Dairy Stores	601-611
32	Auto Dealers and Supply Stores	612-620
33	Eating and Drinking Places	641
34	Other Retail Trade	580-600, 621-640,642-691
35	Finance, Insurance, and Real Estate	700-712
36	Business and Repair Services	721-760
37	Automotive Services and Repair	750-751
38	Other Business and Repair Services	721-742, 752-760
39	Personal Services	761-791

	Title	1980 Census Codes
40	Private Households	761
41	Beauty and Barber Shops	772-780
42	Other Personal Services	762-771, 781-791
43	Entertainment and Recreation Service	800-802
44	Professional and Related Services	812-892
45	Health Services	812-840
46	Educational Services	842-860
47	Social Services	861-881
48	Legal, Engineering, and Other Services	841, 882-892
49	Public Administration	900-932
50	Military	942
51	Industry Not Reported	951-990

BROAD GROUPINGS FOR OCCUPATION

	Title	1980 Census Codes
1	Executive, Administrative, and Managerial	003-037
2	Executive and Administrative Occupations	003-019
3	Management Related	023-037
4	Professional Specialty	043-199
5	Engineers, Architects, and Scientists	043-083
6	Health Diagnosis and Treatment	084-106
7	Teachers	113-163
8	Other Professional Specialties	164-199
9	Technicians and Related Support	203-235
10	Sales	243-285
11	Administrative Support	303-389
12	Secretaries, Stenographers, and Typists	313-315
13	Records Processing	325-344
14	Mail and Message Distribution	354-357
15	Other Administrative Support	303-309, 316-323 345-353, 359-389
16	Service	403-469
17	Private Household	403-407
18	Protective Service	413-427
19	Food Preparation and Service	433-444
20	Health Service	445-447
21	Cleaning and Building Service	448-455
22	Personal Service	456-469
23	Farming, Forestry, and Fishing	473-499
24	Farm and Other Agriculture Occupations	473-489
25	Forestry and Fishing	494-499
26	Precision Production, Craft and Repair	503-699
27	Mechanics and Repairers	503-549
28	Vehicle, Mechanics, and Repairers	505-517
29	Other Mechanics and Repairers	503, 518-549
30	Construction Trades	553-599
31	Carpenters	567-569
32	Electricians	575-577
33	Painters	579
34	Other Construction Trades	553-566, 573, 583-599
35	Extractive Occupations	613-617
36	Precision Production Occupations	633-699
37	Supervisors, Production Occupations	633
38	Precision Metal and Wood Working	634-659
39	Precision Textile and Apparel Workers	666-688
40	Precision Food Production	686-688
41	Other Precision Production Occupations	675-684, 689-699
42	Machine Operators, Assemblers, and Inspectors	703-799
43	Machine Operators and Tenders	703-779

	Title	1980 Census Codes
44	Metal, Plastic, and Woodworking Machine Operators	703-733
45	Printing Machine Operators	734-737
46	Textile and Apparel Operators	738-749
47	Machine Operators, Assorted Materials	753-779
48	Fabricators, Assemblers, and Hand Working Occupations	783-795
49	Inspectors, Testing Samplers, and Weighers	796-799
50	Transportation and Material Moving	803-859
51	Motor Vehicle Operators	803-814
52	Other Transportation Occupations	823-859
53	Handlers, Equipment Cleaners, Helpers and Laborers	863-889
54	Construction Laborers	869
55	Laborers, Except Construction	889
56	Other Handlers, Cleaners, and Laborers	863-867, 873-888
57	Military	905
58	Homemaker	914
59	Occupation Not Reported	913, 915-999

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